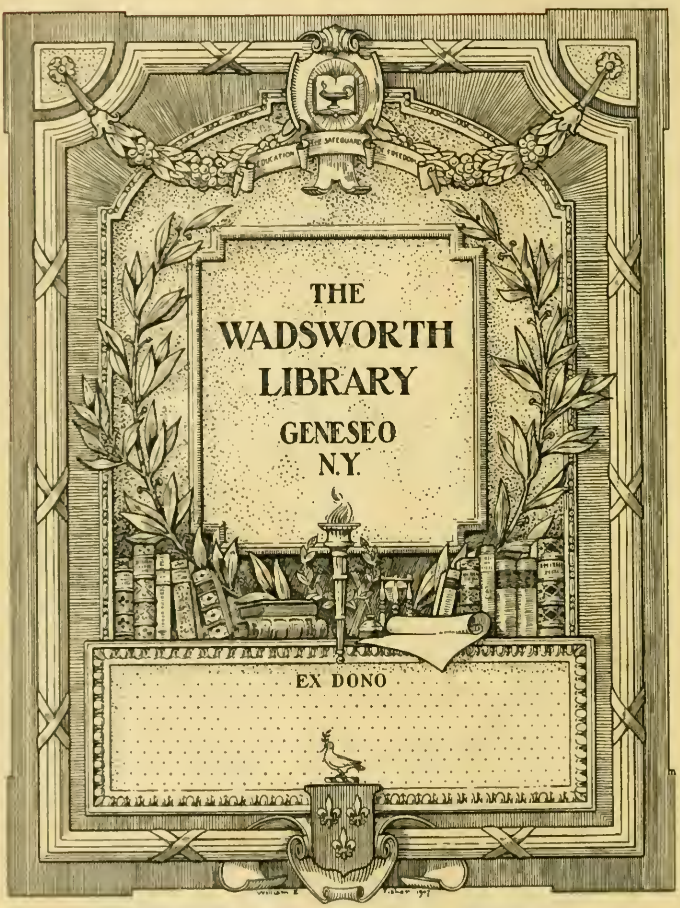
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BUENA VISTA RANCHE, SONOMA COUNTY, CALIFORNIA: RESIDENCE OF A. HARASZTHY.

GRAPE CULTURE,

WINES, AND WINE-MAKING.

WITH NOTES UPON

AGRICULTURE AND HORTICULTURE.

BY

A. HARASZTHY,

COMMISSIONER TO REPORT ON THE IMPROVEMENT AND CULTURE OF THE VINE IN CALIFORNIA.

With Numerous Illustrations.

NEW YORK:
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H

PREFACE.

I SUBMIT this work to the kind indulgence of the people of California.

The short time allowed me to complete a work of such magnitude and importance will, I hope, serve as a partial excuse for its defects.

To make a tour through a large portion of Europe—examine and collect information—select vines and trees—write the following work, with many of the extracts translated from eminent foreign authors and reports of scientific committees, I was allowed, including my journey to Europe and my return, but seven months and twenty-five days.

The task was augmented by extensive and necessary correspondence with government officials, scientific societies, and eminent writers.

During this time I have allowed myself little time for rest or recreation; and if I have succeeded in fulfilling my duty to my State and to her people, I shall feel myself amply rewarded.

I plead for a lenient judgment on the work on account of my defective English, being a native of Hungary, although a naturalized American citizen, which will, I hope, fully explain this unavoidable defect. That my readers will understand my meaning without difficulty is all that I dare hope.

The translations contained in the work were, in most cases, necessarily literal, and therefore presented difficulties not easily overcome.

With these explanations, the author presents his work to the agricultural public, sincerely hoping that future experience may not belie present promises, but that the matter upon which it treats may prove a valuable and an enduring source of wealth to the American horticulturist and farmer. A. H.

BUENA VISTA, *Sonoma County, California.*

REPORT.

To the Honorable the Senate and Assembly of the State of California:

In accordance with a joint resolution of the Assembly, adopted March 2d, 1861, and concurred in by the Senate, April 1st, 1861, authorizing and requesting his Excellency the Governor to appoint a commission to report to the next Legislature upon the ways and means best adapted to promote the improvement and culture of the grape-vine in California, I have the honor respectfully to report as follows:

Having been appointed by his Excellency the Governor, J. G. Downey, upon said commission, I first considered the best mode of fulfilling the duties imposed by the above resolution.

It became evident to me that the objects of the Legislature would be best secured by an examination of the different varieties of grapes, and the various modes of making wine, in the wine-growing countries of Europe, and I communicated this view to the Governor, and offered my services to proceed to Europe, if he should think it desirable. He approved my suggestion, and sanctioned the enterprise, and I at once proceeded on my journey. On my way I stopped at Washington, and was supplied by the Hon. W. H. Seward, Secretary of State for the United States, with a circular letter, directing the diplomatic agents of the United States in Europe to afford me such assistance as lay in their power in this important mission.

On my arrival in France, I opened a correspondence with the different imperial agricultural and horticultural societies, requesting them to furnish such information and letters of introduction as would facilitate my object. They responded with cheerfulness; and I was received with distinction, and afforded every opportunity for obtaining the information I required; in fact, I met with general courtesy wherever I went.

I visited various parts of France, the Netherlands, Holland, Rhenish Prussia, Bavaria, Nassau, Baden, Switzerland, Spain, Italy, and England. Various examinations confirmed my previous conviction that California is superior in all the conditions of soil, climate, and other natural advantages, to the most favored wine-producing districts of Europe, and that it actually has yielded con-

siderably more per acre. All this State requires to produce a generous and noble wine is the varieties of grapes from which the most celebrated wines are made, and the same care and science in its manufacture. This conclusion is the result of a thorough investigation, and frequent consultations with many eminent men in Europe, who assured me that the quality of the grapes governs, in a great measure, the quality of the wine; a fact proved by many scientific experiments, showing that, even in the least favored localities, where common wines were ordinarily made, the finest and most costly wines had been produced by planting the best varieties of grape.

Having provided myself with analyses of the soil of California from various locations, it was not difficult to obtain a correct estimate of its average capacity as a wine-producing State. From all the information I have been able to get, our climate and soil are greatly in our favor.

In view of all these facts and the purpose of my mission, I determined to make arrangements to purchase a quantity of vines, and also to examine every celebrated wine-making establishment within the limits of my tour, so as to learn and describe the newest and best methods of making wine. I did not limit my observation and study to the manufactories alone, but procured the reports of scientific committees, appointed by different governments to investigate the subject by means of practical experiments, continued through a series of years. I also obtained the proceedings of the Congress assembled, by order of the government of France, for the purposes of comparison and consultation, and which was composed of the most scientific chemists and practical winemakers. I availed myself of the reports of similar assemblies held annually in Germany, and of the newest and best works in various languages, written by able men, who had spent their lives in the business of vine culture and wine-making.

It is proper to remark here that I discovered that the countries through which I traveled possessed a lucrative trade by making raisins, drying figs and prunes, raising almonds, cultivating mulberry-trees for the sustenance of silk-worms, and, above all, producing sugar at enormous profits from the Sorgho, Imphee, and the sugar-beet; and I therefore thought it advisable to add to the more strict duties of my mission an investigation into these branches of industry, and to procure the best and newest works concerning them.

I was gratified to find that of all the countries through which I passed, not one possessed the same advantages that are to be found in California; and I am satisfied that even if the separate advantages of these countries could be combined in one, it would still be surpassed by this State when its now dormant resources shall be developed.

California can produce as noble and generous a wine as any in Europe; more in quantity to the acre, and without repeated failures through frosts, summer rains, hailstorms, or other causes.

The quantity of raisins, currants, figs, almonds, olives, and prunes which we could raise would surprise the most sanguine of our people. The mulberry and the silk-worm would occupy and give support to many industrious females, who have now no remunerative employment, in the rural districts; would aid the small farmer in his efforts to raise and educate a growing family, and would add largely to the wealth and revenue of the State.

In my opinion, no country can surpass this in raising the sugar-beet, Sorgho, and Imphee. There is no part of the world, except perhaps Africa, which can produce the same quantity of these commodities to the acre. The present mode of making sugar from these products is so simple that every farmer, at an expense of $30 for machinery, can manufacture enough for his own use, and have a considerable overplus each year for the market. The capitalist, too, may safely invest his money in this lucrative business, and enrich himself as well as the State.

The countries I visited in which these products were cultivated and manufactured derive from them a considerable revenue, as their statistics show; and there is no substantial obstacle to prevent the agriculturists of California from engaging in all the enterprises I have mentioned. The high price of labor here is more than counterbalanced by the greater value of land, and the enormous taxes on these productions in Europe. The development of these branches of industry would not only add to the wealth of the State, but it would also lead to a large immigration from Europe. Men conversant with these businesses have not hitherto migrated to California because they had no hope of suitable employment. Capitalists, ignorant of these resources of the State, have not considered the advantages they present for investment. Manufacturers who have grown wealthy in the older countries, having sons or junior partners, would gladly open branch-houses here as soon as it was known that they could purchase an ade-

quate supply of the raw material in this State. But it would be impossible to enumerate all the benefits which this State would derive from such an increased application of her agricultural capacity. Residents of California who have visited our plantations, vineyards, and farms, and who have attended our district and county fairs, may be able to appreciate these just anticipations.

European governments, well knowing the importance of agriculture and horticulture, appropriate large sums every year, in various ways, for the encouragement of these most important branches of their wealth. Agents are sent to all parts of the world to collect information, to report on new inventions and ameliorations, and to purchase new varieties of vines, trees, seeds, etc. Botanical or experimental gardens are kept, where the plants, vines, or fruit-trees are propagated, and then sold to the people for cost price, or given free of charge to each and every community, according to population, for distribution among its landholders. Scientific and practical men are employed at high salaries as officers of agriculture and horticulture, whose duty it is to make experiments in all their various branches. The magnificent agricultural and horticultural schools, with their experimental gardens, costs some States hundreds of thousands of dollars per annum, and their statesmen frankly admit that money could not be more profitably expended. It can also be shown by statistics that those States which have expended most money in the encouragement of these departments of industry are now the wealthiest and most powerful, and their people the least in want. I would respectfully recommend that a law be passed appropriating money for the purchase of land for a propagating and an experimental garden, and creating the office of director to supervise the garden; and also the appropriation of a sum to purchase, from year to year, seeds, vines, etc.; and for other necessary expenses in maintaining said garden. In this connection, I would respectfully draw your attention to the fact that, by late treaties with Japan and China, an opportunity is presented to us to penetrate into those countries, which have been secluded for centuries. It is well known that many fruits and plants are raised there which might be of great advantage if introduced into this State. A thorough examination of those countries would probably bring to light some products which have not been thought of here. To leave such inquiries to private enterprise would be a tardy mode of realizing the object. I doubt if half a century would accom-

plish, by private means, what might speedily be attained by official investigation. No private individual, however wealthy, would have the same facilities to investigate and procure seeds and plants as an agent authorized by his government. This is the case in civilized Europe. How much more necessary is such a prestige in semi-civilized countries? The passage of a law for the above purposes may be opposed on the ground that we have a national garden at Washington, but it is well known that the few shrubs and seeds we receive from thence are too often dry and useless.

California ought to propagate only such vines, fruits, seeds, etc., as are congenial to her soil and climate, and in large quantities, so that our citizens can be promptly supplied. The Patent Office represents too varied interests, climates, and soils, to do much good to us here. One might as well say that California needs no Governor, Legislature, or Judiciary, as that our public affairs might be administered from Washington; and, in fact, it would be easier to govern us from Washington, than for the Patent Office to supply what we want for the speedy development of our agricultural and horticultural resources.

In my travels I endeavored to induce capitalists to come among us and establish business places, to purchase the grapes from the small producers as in Europe, and to erect manufactories for making wine and extracting sugar from Sorgho, beet-root, and Imphee. I also urged the formation of a joint-stock company, with a capital of a million dollars, for the planting of vines, olives, almonds, mulberries, etc., in the southern part of the State. The prospect for the consummation of these enterprises is favorable, and especially if the apprehensions of a foreign war should subside.

Whenever there was an opportunity to get an article about California and its immense resources in an influential newspaper, I embraced it, and many government journals heralded our advantages by publishing the letters your commissioner had written to their officials. Permit me to say here that in no way can the object of rapidly populating our State be more effectually accomplished than by authorized agents traveling in Europe, not for the direct purpose of inducing emigration, but of noting the progress of agricultural and manufacturing pursuits. These agents would come in contact with all classes of persons; questions would be eagerly asked, and opportunities be thus afforded to publish the advantages California possesses. Coming from an official source,

the information would be credited, newspapers would refer to it, and, with the aid of the reports of our "State Agricultural Society" (which I was fortunate enough to possess), these authorized statements would be authenticated by the enumerated premiums and descriptions from visiting committees. It excited surprise that a State so young and so isolated should have already such wealth of agriculture and horticulture as I proved; and this surprise among Europeans is not so wonderful, as California was there known principally for its gold. Even our Eastern brethren were astonished when I showed from our reports the extraordinary productiveness of our soil and the salubrity of our climate. The appropriations made by the Legislature for the printing of the proceedings of the "State Agricultural Society" have, and will continue to bring back many times their amount. It would be well to distribute these evidences of our resources in such a manner as would reach more directly the people in the East and in Europe. Books sent to other agricultural societies generally fail to reach the public, being mostly retained in their libraries; but if they were sent to the editors of prominent newspapers, they would receive a much wider circulation.

I have purchased in different parts of Europe 100,000 vines, embracing about 1400 varieties; small lots of choice almonds, olives, oranges, lemons, figs, pomegranates, and Italian chestnuts —enough to propagate from by grafts. The majority of the grape-vines I have engaged I have seen bearing. From those countries which I was unable to visit I ordered, through our consuls (to whom I remitted the necessary funds), such products as I thought necessary, and I have no doubt they will be forwarded in time to be dispatched from Havre with the others. My contracts were made, in all places, in presence of the United States consul, leaving the money with him to be paid when the vines, etc., were delivered, and instructing the consuls to send them, so as to arrive in Havre on or a few days before the 1st of December, 1861. A gardener whom I employed will attend to their proper shipment, take charge of them on the voyage, and repack them in New York, where arrangements have been made with Wells, Fargo, & Co., for their farther transportation to San Francisco, under the care and supervision of the gardener. All necessary precautions have been taken, and I am confident they will arrive in the very best order. They are expected to reach San Francisco by the steamer due on the 23d of January, 1862. As I do not know

the exact freight and expenses, I am not able to state the amount of cost and charges to your honorable body, but will do so as soon as possible.

It may not be irrelevant here to mention the fact that in California, as well as in the Eastern States, the public mistrust the purity of California made wines in the hands of merchants. Whether merchants do or do not adulterate the wine, such doubts injure its character, and restrict its sale greatly. Therefore, to insure confidence, and prevent such adulterations, I would respectfully submit whether it might not be a wise policy to pass an act appointing a general agent for the State, who should reside in San Francisco, and to whom the wine-producers could send their wines to be sold; the agent to sell the wine at the prices fixed by the manufacturer, with the proprietor's label on the bottles, or, if in barrels, with his name attached thereto. This agent, so appointed, to receive from the owners of all wines or brandies sold a commission, to be fixed by law, and not to exceed the commissions usually received by merchants; the agent to defray the expense of office and cellar out of the commissions he may receive. The law creating said office might also impose heavy fines and confiscation of the liquor belonging to any individual who should send for sale adulterated articles. Such an office would be no burden to the State nor to the wine-growers, as it would be optional with them to send their wines to this officer or dispose of them in any other way. Every producer, however, would find it to his advantage to avail himself of this medium, as he would meet a ready sale, and pay no more than the usual commissions, while he would aid in preventing frauds, and thus create confidence in the genuineness of our wines. The agent would have to be strictly impartial. All the samples should be indifferently exposed and accessible to purchasers, who could select the wines best suited to their tastes. The agent should be required to give ample bonds for the faithful and impartial performance of his duty, and for the prompt payment of all receipts on account of sales.

This plan would, I believe, restore confidence, and be at least a check upon poisoning our people by our own productions.

His Excellency the Governor has directed me to propagate the vines expected to arrive here from Europe at Sonoma, and hold them and the increase subject to the future disposition of the Legislature.

I have the honor to annex to this report a condensed statement,

which will serve to show the contents of a work I propose to publish, and which will contain a full account of what I personally observed and inspected in Europe, with extracts from foreign works, reports of committees, eminent writers, practical vintners, farmers, horticulturists, manufacturers.

As soon as this work is completed, which will be, I think, before the adjournment of the Legislature, I will furnish a printed copy to each branch of your honorable body.

Not having been able, since my recent return, to learn any thing of my colleagues and their labors, I respectfully submit this as my report, and I have the honor to be, with distinguished respect, your obedient servant,

A. HARASZTHY,
Commissioner on the Improvement and Growth of the Grape-vine in California.

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GRAPE CULTURE AND WINE-MAKING.

CHAPTER I.

FROM SAN FRANCISCO TO PARIS.

Appointment as Commissioner.—Preparations.—Departure from California.—Circular Letter from Mr. Seward.—Voyage to Europe.—Arrival at Paris.—My Son.—Correspondence.—Departure for Dijon.

HAVING received from his Excellency the Governor, J. G. Downey, the appointment of "Commissioner upon the Ways and Means best adapted to promote the Improvement and Growth of the Grape-vine in California," I proceeded to Sacramento to lay my plan before the Governor, and received his sanction to go to Europe for the purpose of collecting information, and such vines and trees as in my judgment were best adapted for our State. The Legislature not having made any appropriation for the purpose of defraying the necessary expenses, I had to make use of my own means, which I cheerfully did, having been assured that my traveling expenses and money laid out for the purchase of the vines and trees would be refunded by the next Legislature. The Press in various parts of the State approved the mission, and spoke in favorable terms of the same; in fact, the general sentiment of the people favored and encouraged me in the undertaking.

Accordingly, I soon made my preparations, and on the 10th day of June, 1861, I started from San Francisco on the steamer *Golden Age*. The passage was pleasant and quick. Arriving in New York on the 4th of July, I rested for two days. I then proceeded to Washington to procure my passport. I was presented by Messrs. Latham and M'Dougal, United States Senators from California, to the Honorable William H. Seward, Secretary of State, who gave me a circular letter to the United States diplomatic agents in Europe, which reads as follows:

"*To the Diplomatic Agents and Consuls of the United States in Foreign Countries.*

"*Department of State, Washington, 6th July*, 1861.

"GENTLEMEN,—Mr. A. Haraszthy, the bearer of this communication, has been appointed by the government of the State of California to proceed abroad for the purpose of collecting information in regard to wine-producing countries, and reporting the results of his observations and inquiries to that government.

"I will consequently thank you to extend to him any facilities which may be necessary for so important an object.

"I am your obedient servant,

"WILLIAM H. SEWARD."

Having been furnished with the above letter and my passport, I returned to New York and embarked on the Hamburg steamer *Hammonia* for Southampton on the 13th of July. The passage was agreeable, the weather being fine. We arrived in port in the morning of July 26th.

After landing, we procured a carriage and drove into the surrounding country, examining several farms and manufactories. Returning to town in the evening, we took at midnight a French steamer for Havre, where we arrived next morning at 11 o'clock. The Custom-house officers very civilly passed our baggage without inspection. After partaking of a good breakfast at our hotel, we strolled through the town, and at 5 o'clock in the afternoon started in the extra train for Paris, where we arrived at 11½ o'clock that night.

We took lodgings in the Hotel de Louvre. The next day I saw my son Arpad, to whom I had telegraphed from Southampton. My son had been four years at school in Paris, and latterly in the Champagne districts, where he is now learning the manufacture of Champagne and other wines. He proved a great assistance to us during our stay in Europe; he acted as my secretary, my correspondence with scientific societies increasing daily, as well as with prominent officers of different governments. He copied also my journal entries, in which duty, however, he had the assistance of my daughter, as he was not able alone to copy both letters and journal.

The first day of our arrival being Sunday, we enjoyed a good rest, which was much needed after our long journey. The following day I called upon the United States minister, Mr. Dayton. This gentleman, being so much occupied in getting up his dispatches, was unable to receive me. Finding through his secre-

tary that it would be several days before he would be able to see me, and it being doubtful whether he could aid me much in the way of introductions to presidents of horticultural and agricultural societies, I determined to write to them myself, inclosing a copy of my commission. This course was adopted for two reasons: first, because my own time was very limited, and, secondly, in order not to trouble the minister too much.

It was now the beginning of August, and every body who could do so was leaving Paris. We found the presidents gone with the rest to the country. We ascertained this fact several days after our letters had been written. Meantime we visited the vineyards and farms around Paris. Having ascertained the whereabouts of the officials, we started to Dijon, August 6th.

CHAPTER II.

THE BURGUNDY WINE DISTRICT.

Start for Dijon.—Observations on the Road.—Arrival at Dijon.—Professor Ladrey.—Aged Vines.—The Market.—Inferior Fruits.—The Botanical Garden.—Its Vines.—Visit Gevrey.—Prices of Vineyards and Wines.—Manufacture of Red Wines.—The Pineau Vineyards.—Vineyards of Chambertin.—Wine-vaults at Morey.—The Fermenting-room.—The Press.—The Gamai Vineyards.—Beaune.—Casemates used as Wine-cellars.—Clos Vougeot.—Wine-presses 754 years old.—The Press-house.—Mode of testing Wines.—The Cellars.—Quality of Burgundy Wines.—The Côte d'Or.—The Vineyard of Clos Vougeot.—The Pineau and the Gamai Grapes.—Mode of laying out a Vineyard.—Experiments in Planting.—Treatment until bearing.—Three-bud Pruning.—Aspect of the Vineyards.—Ouvries.—Manuring Vines.—Keeping close to the Ground.—Pruning for large and small Crops.—Burgundy Vines must be cultivated as at Home.—The Vintage.—Fenced Vineyards.—Unfenced Vineyards.—Laws regulating the time of gathering Grapes.—The Laborers.—Small Proprietors make inferior Wine.—The fewer the Grapes the better the Wine.—Return to Paris.

August 6.—Left Paris for Dijon. The country through which we passed was chiefly undulating hills planted with the sugar-beet, which looked very fine. In the distance could be seen several sugar manufactories, with their tall chimneys and fine out-buildings. All along the railroad the land was parceled out into very small lots, eight or ten feet wide and two hundred feet long. To one accustomed to the broad fields of America, it is very strange to see so many strips of land, all belonging to different persons. Of course, these lots are all planted according to the idea of the owner; therefore, as you whirl rapidly by, you will see first a patch of vineyard, then oats, wheat, barley, etc., creating a very curious effect, till you know how valuable land is in this densely-populated part of the world. On my way I also saw several fine meadows planted with clover, or what we Californians call alphalfa. The strips of land are plowed in a curved shape on the hill-sides and in very low land. The reason of this is, that if the water were to run through a straight furrow it would be so rapid that the soil would be washed away. The lands are from four, five, to six feet, and thrown up by the plow, but it is done most beautifully regular. I have seen several men plowing very

finely in spite of their plow, which is a primitive machine for this enlightened age. It is furnished with a wheel on the side of the beam.

Grain is now ripe, and they are beginning to harvest it. Men, women, and children may be seen in the fields, with sickles, hard at work. This is very singular to the eyes of a California farmer who finds the Reaper a slow machine which cuts from sixteen to twenty acres in the day, and requires binding, heading, and stacking; therefore he lays it aside for the Header, which cuts, thrashes, and bags his grain all in the same day. However, this machine could not be used in this part of Europe, where the land is subdivided into so many parcels, and the owners have enough help to pick the head off every stem, if it is necessary, with the hand; and, if a head should fall from the wagon, it is picked up with all care; so you may guess there is not much chance for herds of cattle in this part of France.

The grain does not grow to a great height here. The barley and oats are about eighteen inches or two feet, and the rye about two and a half feet high. On this route I did not see any wheat. For carrying the grain the inhabitants generally use a donkey. They pack on him the grain, straw, etc., whatever it may be. The wealthier class use a two-wheeled cart, which has a rack on both sides; in front and rear there is a fork, which resembles the fingers of an American cradle. To this is attached a rope, by which the rack may be lowered or raised. In this manner the cart is easily and well packed. Those who are too poor to keep a donkey carry the scanty produce upon their backs to their homes, which generally are four or five miles distant. From this the reader can well imagine that not even a blade of grass is allowed to be wasted.

The color of the ground in some places is white, but in general is a pale red, and very much exhausted. There are but few fruit-trees, and they are very badly attended to: they look very wretched. The vines are very small, and in the vineyards may be seen many yellow sprouts, which is a sign of decay.

We crossed several roads, all of which excited my greatest admiration by the fine order in which they are kept. They are smooth and hard as a billiard-table. All along their borders, at a distance of twenty yards, are piled up fine small stones: in case a hole should be made in the road, the inspector need only take a handful or two of these stones to fill it up immediately. This

prevents it from becoming dangerously large; and both man and beast may travel all over France with perfect security and with pleasure. The meadows are generally shaded by poplars, planted in rows. The banks of the river and canal are also ornamented in the same manner, which has a very pleasing effect on the eye. We passed through many small villages, where there are some very ancient cottages built of gray stone, or still having the thatched roof. In the distance can be generally seen some chateau, peeping from beneath innumerable shade-trees.

The town where the train stops has several sugar manufactories surrounding it. After leaving this town the country begins to be hilly. The strata on the soil is lime and a mixture of magnesia cement. The whole is planted with vines, even the steepest hills, which a person ascends with difficulty. The vines here also show very yellow leaves and sprouts. Across the meadow, which is about two miles wide, on the left side of the road, the ground rises again into hills, all of which are planted with vines.

During our journey we passed through several tunnels of different lengths, but the last, about twenty miles from Dijon, was at least five or six miles long.

At six o'clock we arrived in Dijon; went to the Hotel de la Cloche, where, after washing off the dust that almost buried us, we took dinner at the table d'hôte. It was the finest dinner I have eaten since the beginning of my tour. There were more than a dozen dishes neatly served up and delicately cooked. After dinner we went out to look at the city. Walking through its principal streets we saw the City Hall, which is a fine, ancient stone building. The Cathedral, a time-honored edifice, with finely-proportioned columns and many Bible scenes carved in stone, may also be seen.

After taking a cup of coffee we returned home and addressed a letter to Professor Ladrey, and inclosed the letter I received to him from the editor of *l'Echo du Pacific.* I requested the favor of a personal interview. After dispatching this letter we retired, well satisfied with the city, dinner, and excellent bed.

I arose at seven o'clock, after passing a sleepless night. The whistle of the night-trains, the rolling of the omnibuses to and from the stations, kept me awake the whole night; and in the morning the chattering of men and women, the notes of a musical donkey immediately under my window, the shrill voice of the venders of fruits, vegetables, etc., deprived me of my morning's

nap. After dressing we went through several of the squares or *rotondes* of the city (there are none of any regular form). There are to be found several fine fountains, and in the east half square a group of well-executed statues. There is a monk on the summit, supported by the figures of monks, popes, etc. The representation we could not make out. From these we went and inspected the interior of the Cathedral, the market, etc.

During our walk I saw several vines trained up to the second story windows of a house, and very heavily laden with grapes; a fair estimate would be seventy to eighty pounds to the vine. But what surprised me was that the grape-vine was planted so close to the house that the wall must rest upon half of its root, while on the other side are laid the heavy stones of the pavement, which must have rested there already many years. This is a positive proof that after a certain age a vine can live and bear a quantity of fruit without being hoed, or the ground loosened around its roots. These vines must be at least fifteen, twenty, or perhaps fifty years old. The leaves and fruit are large and healthy-looking. Upon pointing out the above to Arpad, he told me that a man named Rose had paved his vineyard as an experiment, but his successor, laughing at the idea, had the stones taken up, so that the experiment was never made. When I return home I will try it with vines of different ages. If it should succeed it would be a great economy, and the grapes resting on stone would be clean, and could not impart a ground taste to the wine from the quantity of dust which sometimes is upon them.

From these we went to the market. Here we found women sitting on both sides of the street selling fruit, vegetables, earthenware, etc. Leaving this noisy, and, I must confess, dirty-looking street, we turned into a covered market, where the women sell butter, cheese, etc. At the end of this market is a very large, ancient building, also filled with female venders of meats, fish, vegetables, etc. Here the noise reached its height, and resembled the hoarse roar of the Niagara Falls. Driven out by the old cheese and various other perfumes, we left to seek a more quiet and cleaner place.

I here found with astonishment that the fruit was inferior to that of California. The markets of San Francisco, Sacramento, Marysville, even the mining towns, produce a finer display of fruit than these large venerable towns. The reader must not suppose that I am influenced by partiality for my own State when I make

my remarks. The object of my travels is especially to note down every thing in which the Europeans surpass us, and afterward lay them before the citizens of the United States. This task I will fulfill to the very best of my judgment.

At half past ten we returned to our breakfast, which did not prove inferior to our dinner of the preceding day. Indeed, it seems as though the landlords of Dijon are determined to fatten their guests at the shortest possible notice by administering to them the most delicate viands. The wine (which we added extra to our meal) was excellent. I say "added extra," because every guest is given a bottle of wine to his meal; and I will taste all the wines raised in the places through which I travel, as I wish to know whether the exported wines are worse or better than those which are common at home.

To-day Professor Ladrey called on us. During the conversation he promised to come in the evening, as, it being examination-day, he was occupied. He also offered his services for the next eight days to show us the surrounding vineyards, nurseries, orchards, etc. The professor is the editor of *La Bourgogne*, a monthly magazine on the culture of wine, and president of the Dijon wine district. He is also author of several chemical works on wine, etc. He seems to be a very gentlemanly and accommodating man. We met Monsieur Ladrey at seven. He spake very ably concerning the wine culture, and informed us that there was a fine botanical garden in the city. After leaving him we went through it, and also the old Cathedral, which boasts of a few fine oil paintings. There is also an aqueduct here worthy of notice; it extends four leagues from the city. By this means Dijon is well watered.

August 10.—This morning we went with Monsieur Ladrey through the botanical garden. The most interesting to me were the grapes, of which there are six hundred varieties. Partly planted at the foot of a high wall, they are trained over a net-like wire fastened to the wall. Some of these vines are twenty years old, and do not present a very inviting aspect, their leaves being withered, and mildew having attacked them and the grapes. The best and finest are the Persian Seedlers, which are transparent, with a beautiful healthy color, but a little late in the season. The Chasalas Fontainebleau looks thrifty and healthy, but the Palestine mammoth grape is poor, and most of the berries are dried up. The gardener ascribes this to the cold and changeable

weather they have had this year. The Catawba, Isabella, and Scrapanay are among the varieties. The vineyard, placed on a small gravelly knoll, is doing much better than the above-named trellis-work. This may be on account of the vines not being so old, as some are only two and six years old. On being told their age, I was much surprised to see how small and feeble they were in wood, and backward in bearing. I was told that they were also manured. This is the first time many of them bear, as even the acclimated vines do not produce fruit until they are five years old, and very little then. After thanking the director, we agreed to enter into correspondence, and exchange all varieties of vines, seeds, etc., which the one does and the other does not possess. This institution is supported by the city of Dijon. It does not sell any of its roots, but exchanges with societies and individuals.

Upon leaving the garden we started for Gevrey, a small village half an hour's travel by railroad from Dijon, and which is surrounded by the most celebrated vineyards in this district. As the cars do not pass Gevrey, we stopped at Chambertin, took an omnibus, and proceeded to Gevrey; having letters from M. Ladrey to the overseer of a gentleman's vineyard. His absence from home enabled us to take our breakfast before starting out. During the preparation of our meal, we endeavored to ascertain from the talkative landlady whether a vehicle could be obtained. She did not know; but her husband, upon our assuring him we were not aristocratic, comforted us with the remote hope of procuring us a coach to drive to some of the neighboring vineyards. We were not able to get the promised conveyance till twelve o'clock. Therefore we took a stroll through the village, which, like all French towns, is irregular in its construction, and composed of stone houses two stories high. The whole village has an air of comfort and prosperity about it, which proves that even here the cultivation of the vine is quite remunerative. At last our man arrived. I put a series of questions to him, and gained the following information.

Gevrey is inhabited chiefly by peasants, either possessing vineyards in fee-simple, or renting for a period of time vineyards already planted, or warrant-lands which they have planted themselves. The rent of five acres of vacant land for planting a vineyard is 250 to 300 francs, payable annually, the term of the lease being from 20 to 30 years. No allowance is made for the time the vines are not bearing. Planted vineyards pay a rent of from

350 to 500 francs per five acres. The price of a vineyard, when for sale, varies with its location. The first class Pineau vineyards are worth from 40,000 to 60,000 francs per hectare;* the second class Pineau vineyards, 30,000 to 40,000 francs per hectare. The first class Gamai vineyards, 30,000 to 40,000 francs per hectare; the second class, 15,000 to 25,000 francs per hectare. The price of the wine is also very variable. For instance, wine raised in 1846 from a first class vineyard sold at 2000, 3000, and even 4000 francs per barrel, which contains 60 American gallons. In usual vintages, wine of the first class, when through the first fermentation, sells from 1000 to 1500 francs per barrel, sometimes even more; the second class, from 500 to 1000 francs. The wine made of the Gamai in celebrated years will sell for 800 to 1500 francs; in common years, 250 to 400 francs. Nearly all wines made here are red. The few white wines are not at all celebrated.

The mode of making the red wine is very much the same in the whole district. The grapes are picked by men, women, and children, from September to the 10th of October. They are placed in baskets, and carried to wooden tubs with leather straps on each side. There are several of them scattered in different parts of the vineyard. When these tubs are full, a man passes his arms through the straps, lifts the tub to his back, and carries it to the large trough which is placed in a central part of the vineyard. He empties the grapes into the trough, where the men crush them with their feet. The crushed grapes, juice and all, are then carried in a donkey-cart to the village, where they are thrown into a large fermenting-vat. The people do not live in their vineyards, but have their cellars generally in the village. The fermenting-vat is about 4½ feet high, and holds from 10 to 20 or even 30 barrels of wine. When they have remained in this tank from 24 to 40 hours, the fermentation will send the stems and seeds to the top of the vessel, forming a hard mass. Then, according to the size of the tank, from four to ten men, stripped of all their clothes, step into the vessel, and begin to tread down the floating mass, working it also with their hands. This operation is repeated several times, if the wine does not ferment rapidly enough. The reason given for this, in my eyes, rather dirty work, is that the bodily heat of the men aids the wine in its fermentation; but this object might be gained by throwing in heated stones, or using pipes filled with steam or hot water.

* The hectare is two and a half American acres.

After the above-named operation is completed, the wine is left to ferment two and a half to three and a half days longer, or four or five days from the time when the tank was filled. If the weather is warm, four days and nights are sufficient; if it is cold, it requires five days. In rare cases, the cellar is heated with stoves. The wine, after its fermentation, is drawn from the tank by a siphon, incased by a tube made of willows, with a wicker-work across the end, which is plunged through the seeds and stems to the bottom of the tank. If the end of the siphon was not covered by the wicker-work, it would soon be choked up by the stems and seeds. The clear juice flowing from the siphon is taken in tubs to the cellar, and emptied into barrels already in their places. These barrels are filled but two thirds full. When the tank has given up its clear juice, the stems, etc., are taken out, and put into a press, where the remainder of the juice is forced out. With this juice the barrels are filled to within two inches of the top. This wine remains quiet for about a month, when the barrel is completely filled and bunged up.

In the month of March these barrels are emptied into others, where the wine is cleared with eggs; then it is again drawn off in this first year of its existence. Many, in this district, draw off their wine as often as three times in the year. In years when the rains are heavy, or when from any cause the grapes are deficient in saccharine matter, sugar made from potatoes, known as "grape sugar," is added, to the amount, often, of thirty pounds to each sixty gallons. This is thrown into the vat where the wine is fermenting.

After a short conversation with the overseer, we were agreeably surprised to see a vehicle drive up to the gate. It was furnished with a good horse and driver, and was, moreover, a good example of the love of comfort cherished by the ancients, for that carriage has surely witnessed the rise and fall of many dynasties. Our landlord mounted the box with the overseer. The driver, on closing the door, asked our permission to place a lad of fifteen years in the box behind, where in good old times the servant took his place. Of course we had no objection, as it added to our aristocratic appearance, and the horse did not belong to us.

On leaving Gevrey, which is situated on rather high ground, we passed vineyard after vineyard, until we came to the elevation where are planted the Pineau grapes, which produce the celebrated red wines. The ground rises slowly to the top of the hill,

and is of a red color, thickly strewn with gravel. The vines are planted two and two and a half feet apart, and not very regularly. The stems are not thicker than from three fourths to one and one and a half inches. The shoots are from three to three and a half feet high, where they are topped. They are tied to oak or locust sticks three and a half feet in height, and from one half to three fourths of an inch in thickness. The vines are tied either with straw or twigs. These vines, which we have imported, bear very small bunches, and also small berries. The clusters are more round than long in their form, and the berries are crowded so closely together that one overlies the other. The Pineau vineyards will give from eight to twelve barrels of wine to the hectare. This is generally a very productive year, but not a good wine season. The Pineau vines have only from one quarter to one and a half pounds of grapes; indeed, many vines did not have as much as a berry upon them.

We also examined the celebrated vineyards of Chambertin, the wine of which has a well-deserved and extensive reputation. At a short distance from there is a small village called Morey, which contains a fine cellar forty feet below the surface of the ground. It is all arched, is forty feet wide in the centre, and is supported by pillars of solid stone. The barrels are placed in three rows, two barrels high; but if the vault is much crowded, as many as four tiers are piled up. This cellar is furnished with four tanks, each capable of containing ten barrels of wine. These tanks have a door on the side, so as to enable a man to enter and clean the interior. To prevent leakage, the door is screwed tight to the side. Above this cellar there is still another one, arranged in the same way, which contains the young wines. We tasted many, and found them very good. Thence we went to the fermenting-room, where we saw the vats, press, tubs, etc., in excellent order. The fermenting-tanks, which hold from ten to eighteen barrels, are built of oak, with iron hoops to hold them together. The press, instead of having a screw from the top and pressing the juice out in that way, is made like a large square box, three sides of which are composed of thick wooden bars, about a quarter of an inch apart, so that the wine, but not the seeds and stems, may escape upon the large platform underneath the press, the bottom of which is also a lattice-work of strong bars. This platform is bordered by a scantling an inch and a half thick to prevent the juice from running over. The box above the platform is fur-

nished with one solid oak slide, which is pushed toward the farther end by a couple of iron screws fastened in the planks on the one end. The other end has a cast-iron wheel, and each of the screws is furnished with one also, which in turn is driven by a still smaller wheel, on an iron bar which is attached to a fly-wheel worked by hand. When this is moved it starts the close-fitting solid slide of the box, and this presses the substance against the three open-work sides with such force as to extract every particle of juice from the stems and seeds deposited there for that purpose. The wine so pressed is carried in tubs to the cellar, and disposed of as before described.

Five days is generally sufficient for the fermenting of wine in this part, unless it is cold weather, when the overseer sends his men in a couple of times more in their costume *à l'Adam* to create the necessary warmth. The wine of this vineyard sells from 600 to 1500 francs, according to the excellency of the vintage.

We then went to examine the Gamai vineyards. We found that in color, size, and form the fruit very much resembled the Pineau grape; but the bunches are much larger, and the vines bear three times as much as the Pineau. I was told that a tract of land originally planted with the Pineau, which made an excellent wine, was replanted with the Gamai vine, which produced in this celebrated situation much less, and inferior wine to the vineyards of the first class Gamai in the plain. If this be a fact, it shows that the quality of wine depends greatly upon the grape, and *not* entirely on the soil. However, I will examine this theory more thoroughly, and compare it with the practical knowledge acquired by persons who have tried the same experiment.

After seeing every thing here, we returned to the village, discharged our driver, and took the cars for Dijon, where we arrived at six o'clock, very tired and hungry. However, we partook of white wine that evening, as the process through which the red wine goes did not serve to increase our longing for the ruby-colored liquid.

August 11.—This morning we started with M. Ladrey for Beaune, where the Professor L. is well acquainted. We were not very fortunate in our time, as it was Sunday, and almost every one was out. However, we at last found a clerk of a large commercial house which buys up the produce of the neighborhood. This gentleman took us into the vaults or cellars of his establishment. These cellars are the casemates of the ancient

fortress which in olden times had its fortifications around the town. These casemates are now used by the inhabitants as wine-cellars. After descending a steep flight of steps about sixty feet below the surface of the earth, an immense vault met our astonished eyes. It was filled with barrels piled one upon the other. We were led from vault to vault, which now contain but 4000 barrels of wine, but they are capable of holding 12,000. There are also a few large hogsheads, which will hold forty-two barrels of wine. The thickness of these walls are forty feet. Of course, no private individual could build such a wall without its costing him a million of dollars. Little did the founders of this fort dream of the use to which their casemates would be put by the succeeding generations. The vaults in Beaune are now the best in the empire of France.

Having visited all the places of note, we stopped at a bookstore and purchased the map of the surrounding vineyards, with the produce of the district marked; also two books of the district containing statistics of wine-making, the number of acres planted, their price, etc. After having freely conversed with the overseers who make a great deal of wine, I shall be able to judge whether the authors are theoretical or practical men. The maps are very valuable, as they give the quality of the vineyards as well as the nature of the soil.

We then started again for Dijon. The whole surrounding country is planted with vines—the hills with the Pineau, and the plains with the Gamai. Beaune is in the Prefecturate. It contains about 4000 inhabitants, who are generally wealthy and well to do. Much commerce is here carried on with foreign countries.

August 12.—This morning we took the cars for Clos Vougeot. We arrived there at noon, and immediately proceeded to the vineyard of the Clos. The steward very kindly gave us all the desired information. He told me that those vineyards and houses formerly belonged to the priests, who, finding that the vine did well, planted the whole neighborhood. They also built the wine-presses which he now uses. These presses, four in number, were erected in the year 1117 A.D., and have defied the ravages of time. Their massive beams are sixty feet long, four and a half feet thick, and three feet wide, with a large wooden screw about eighteen inches thick and twelve feet high, still standing firm, and promising to last many years more.

There are in the press-house 36 tanks, containing 825 barrels,

or 495,000 gallons of wine. The fermentation here lasts the same length of time as in other vineyards, namely, four or five days in warm weather, and six, or even twelve, in cold. When the weather is cold, the men are sent into the wine as often as three times in the day. As it is a most delicate operation to have the exact quantity of heat, the overseer informed me that he sometimes tested the wine three and four times in the day, either with a wine alcometer and thermometer, or with the palate. When the test is made with the alcometer, he takes portions from the different parts of the barrel—the top, centre, and bottom—and mixes them well together before testing.

We were also taken into the cellars, which are lined with hogsheads of 2400 gallons each. They are three and four hundred years old. They were also built by the priests, and are now kept in splendid order. The vineyards are planted with the Pineau and the Noirier half and half. The wine sells out of the fermenting-tub for 600 francs per barrel.

Burgundy wine was in ancient times considered the noblest and most generous of wines, except the Tokay; the wines from this district were often presented by the Princes of Burgundy to kings, princes, and chief nobles of foreign countries, as a great favor. No banquet was given without the genuine Burgundy; and even in the present age this fine wine holds its own with connoisseurs, and all lovers of a good glass. Industry and science have in modern times elevated the Bordeaux, and have made it a wine more generally used, on account of its mildness, as a table wine; but, nevertheless, the Burgundy is sought for by all nations, and the extensive district planted with its vines can not supply the wants of the trade.

That portion of the district which produces the finest wines is called the Côte d'Or, "Golden Hills." This is a range of hills from Chalons sur Saone to Dijon, running from north-northeast to south-southwest, about eighty miles in length. The height of these hills is from two hundred to three hundred feet; the soil is red and gravelly, containing a good deal of limestone, similar to our Sonoma soil, which also exists in almost every county in California by millions of acres. These hills, with the exception of small spots where the red rock comes to the surface, are planted with vines, the vineyards reaching almost to the top of the hills. The reason why they do not extend to the very crest is that no soil exists on the rocks toward the very top. The first quality

of the wine is produced on the heights. The redder the soil, the better the wine.

I have mentioned that I visited the celebrated vineyard of Clos Vougeot, containing one hundred and eighty acres, surrounded with a solid stone wall. In the middle stands the ancient abbey, which once had more than one hundred monasteries tributary to it. It is a well-preserved edifice, and is now owned by a private family who spend a portion of the time on this domain.

The first-class vineyards plant exclusively the Pineau grapevines, a black grape with a small berry and a small bunch, which produces from a half to one and a half pounds to the vine. This gives the generous and widely famed Burgundy wine.

The second-class vineyards contain the Gamai grape, black in color, considerably larger as to berries than the Pineau, and more prolific, but giving an inferior wine.

The third class are at the foot of the hills, sometimes extending into the valleys. They are planted with Gamai and several other vines, producing blue and white grapes.

The various experiments made with the fresh-pressed juice from the Pineau showed ninety-six degrees of sugar and the greatest weight; while the Gamai, raised alongside, proved to be only eighty-four degrees. In this province, when a vineyard is planted anew, the work is as follows: The ground is laid out with ditches five feet apart and one and a half feet deep; the ground is thrown between the ditches, making a ridge; the ditches are partially filled with good ground manure; the cuttings, eighteen inches long, are placed half a foot apart, bending toward the ridge; the soil is then drawn over the cutting and trampled down by the feet, leaving two buds out. The ridge is planted with potatoes, beans, beets, or cabbages. The first and second year, during the summer, these vines receive two or three hoeings. The first year these plantations do not receive any pruning, but are left to grow as bushy as nature will allow. The second year, in the spring, they are pruned to two buds, and more soil is drawn over, covering the plants up to the cut. Manure is also applied in the rows. In the third year the vines are pruned to two branches, each cut to two buds, and furnished with a stake from four to five feet long. During the fourth, or sometimes during the fifth year, small ditches are made from the vines toward the middle of the rows. The vine then is drawn in this ditch, the root remaining, with one branch, in its original place. The

other branch is bent to the centre of the row, and two buds are left out of ground. The ridges which existed between the rows become, by this operation, leveled, and the whole vineyard now stands planted, two and a quarter feet apart, with vines. During the summer but one vine is allowed to grow up; all the other sprouts are rubbed off.

Many experiments were made by digging up the ground two feet deep, then taking an iron bar, and making a hole, and planting the cutting. This mode succeeded as well as that just described; that is, the vines grew and flourished well; but it was found that, after a certain number of years, the vineyards thus planted yielded but little; so that this mode is now abandoned, and the old ditching and laying system is now in use.

When the vines begin bearing, which is the fifth and sixth year, each retains but one stem, which is cut above the ground to three buds. This mode of cutting to three buds is repeated every year; that is, year after year the wood which possessed the three buds is left, and the new-made wood is cut to three buds. Proceeding thus, in from eight to ten years the vine will be raised to the height of from two to three feet. It becomes, therefore, necessary to bring these vines nearer to the ground, and by this means to renovate and rejuvenate them. This may be done in the following manner: As soon as the vintner sees that a vine is growing too high, he will, in the month of February or March, dig a ditch a foot deep and six inches wide toward a vacant place, without any reference to the line. The vine now is uncovered from the dirt on all sides, and drawn into this ditch. The hole (or ditch) must be just as long as the *old* stem of the vine, so that when laid horizontally the old stem will reach the end. The yearling branch at the end of the old stem is then bent up, the ditch filled with manured soil, and the yearling branch cut to three buds above the ground. About one tenth of the vines are annually so laid, consequently every vineyard is renewed once in ten years. By this operation, of course, all lines are destroyed, the vines standing every way like beans sowed broadcast; but, inasmuch as cultivation is carried on entirely by hand, it creates no inconvenience.

The vineyards are generally divided into *ouvries* (land of a day's work). Such an ouvrie is 3645 square feet, in which ten to fifteen vines are to be laid every year by the hired vintner as a part of his regular duty, the payment being included in his wages; but if it should exceed the above number of vines, he is paid one

sou for each extra vine. The usual wages for working an acre for the year, excepting the packing of the grapes and making the wine, is from eighty to a hundred francs per acre. Many proprietors give their lands on half shares, as I have already mentioned.

The practice of manuring the vines is a necessary evil. It is a well-understood fact that vines produced on soil not manured will be more durable, and clear better, and are, consequently, sooner ready for market.

The general conviction in this district is, that the closer the bud to the main stem, the stronger the wine it will produce; that is, the first bud from the old wood will give grapes less in size than the second and third buds, but it will be a better wine. It is also demonstrated that the top bud will produce wood which is much more prolific in bearing than the wood of either of the other buds.

The reader will understand that by cutting the vine to three buds it will make, of course, three branch vines. The sprouts must be rubbed off, so that these three vines will grow vigorously, and enable the grapes to grow to perfection.

It is generally admitted by all the vintners and French writers that, the closer the vines are kept to the ground, the better the grapes will ripen, and they will contain more saccharine and coloring matter. It is also agreed unanimously by all reports on this subject, that when vines are pruned for large crops many buds will be left on the vines, which will produce many grapes, but they will be neither as sweet nor as dark colored as the grapes from the moderate-bearing vines, besides making an inferior wine without the proper bouquet. In the district of Burgundy the practice of three-bud pruning is in general use. The vineyards being renewed every ten years, as described above, are, of course, kept in splendid condition. We were told that the Burgundy vines exported to foreign countries, and not cultivated in the manner above described, in fifteen or twenty years ceases to bear entirely, or, if at all, in very small quantities.

The vintage is conducted as follows: Those proprietors of vineyards which have stone walls around them, called "*des Clos*," are allowed to gather their grapes whenever they please; consequently, they will begin the vintage whenever their grapes are in the very best condition. This accounts for the fact that the wine from fenced vineyards is better in quality, and commands a higher price in the wine market than that of others.

Those vineyards not fenced, and the largest portion, are subject to the following rules: Three commissioners on vineyards—one proprietor, one merchant, and one vintner—are appointed by the préfect, for the purpose of examining the vineyards from time to time, and reporting to the sub-préfect. When in their judgment the vineyards are fit for the vintage to begin, they report the fact. At the receipt of this report, the sub-préfect issues his order, setting the day recommended by the commissioners for the work to begin. On this day every body is compelled to commence the vintage; but, as their work is performed in a few days, the custom is to order a certain day in one village; in an adjacent one a few days later, and so on, so that sufficient hands can be procured to perform the necessary labor. If this were not done in districts where several hundred thousands of acres are planted with vines, it would be impossible to get the labor necessary, all at the required time.

The laboring men, women, and children, at such appointed time, come from far and near, and collect at the market-place; here they are hired by the vintners, according as they are needed. They are paid more or less, according as the number of laborers are greater or fewer. The gathering is described elsewhere.

The possessors of small vineyards usually sell their grapes to wine-dealers, who come to the vineyards. They either purchase by the measure, or take the whole produce of the vineyard in a lump. The owner of the vineyard invariably has to gather and deliver the grapes to the purchaser, and to pick and select them according to the desire of the merchant.

Those proprietors who have but small vineyards, and do not sell their grapes, but make them into wine, produce, without exception, an inferior quality; not on account of the locality or soil, but for the reason that they do not or can not select their grapes, but throw all together, good and bad—the amount of grapes being too small to make different qualities of wine; the consequence is, that their wine brings indifferent prices.

It is believed, and we think with good reason, that the fewer the grapes on the vine the more perfect they will be, and will receive from nature the full aroma natural to the species, and which makes the wine so celebrated for its bouquet.

Having examined the district of Burgundy in every direction, collecting all useful information, and engaging several thousand cuttings of its celebrated varieties, we prepared to return to Paris.

But, before leaving Dijon, I must here acknowledge my heartfelt thanks to Professor M. C. Ladrey for the kind attention we received at his hands, and for the valuable information, books, reports, etc., which he presented to me. To his accomplished lady and family our gratitude likewise is due. We had the pleasure of partaking of a magnificent entertainment with them.

After bidding farewell to our new acquaintances, we started at midnight by the train for Paris. As it was night we could see nothing, so that we had to spend the time as best we could.

CHAPTER III.

FROM PARIS TO FRANKFORT ON THE MAINE.

Ball at the Chateau des Fleurs.—The Emperor's Fête-day.—The Illumination and Fireworks.—Orderly Conduct of the People.—Departure for Germany.—Observations on the Way.—Ems.—The Casino.—Gambling.—The Promenade.—Dr. Precht.—Donkey and Mule Riding.—The Valley of the Swiss.—Count Stein's Tomb.—Grist-mills.—The Water-wheels.—Silver Mines.—Condition of the People.—The Theatre.—Letters and Visits.—Coblentz.—Difficulty with Bankers.—Start for Frankfort.—Letters of Credit preferable to Cash.—Conversation with Passengers.—Notes by the Way.—Arrival at Frankfort.—Letters of Introduction.—Americans in Frankfort.

August 14.—Arrived in Paris at six o'clock in the morning, after having traveled almost the whole night. I was busily engaged the whole day in writing answers to my correspondents. In the evening, hearing that a public ball was to be given at the Chateau des Fleurs, I determined to see what such a thing was in Paris. The ball was given in the open air, in a garden most beautifully illuminated with lamps of all colors and descriptions. Some were shaped like flowers, and, as such, were scattered profusely among the shrubbery; others represented garlands, and were festooned among the trees, creating a perfect blaze of light. Then there were gas-lights nestling in among the flowers, glittering like so many dew-drops. At the farther end of the avenue was a fine pagoda for the music; this was also most brilliantly illuminated. The whole, when viewed from an elevated platform, had a most entrancingly beautiful effect. But the company was not such as we would like our families to associate with. Most of the females were *grisettes*, each of whom, at the tones of the inspiring band, seemed to forget for the moment her cares and troubles, and to have but one idea—that of excelling her rivals in the dance. After gazing for a time upon this scene of wild gayety, I returned home much fatigued.

August 15.—To-day I intended to leave Paris; but as it is the Emperor's fête-day, and there will be grand illuminations in the city, I have determined to remain over one day.

Evening has arrived. Carriages have been forbidden to go to

the Champs Elysées; the Rue de Rivoli leading to it is in a blaze. Millions and millions of lights decorate public and private houses. The garden of the Tuileries has been transformed into fairy-land. Sceptres and crowns, blazing with lights to represent the finest rubies, diamonds, topazes, and emeralds, are scattered all over. Down the main avenue may be seen, at a distance of every ten or twelve feet, immense chandeliers of wire supporting hundreds of lights. The ponds are encircled with lamps. From the Tuileries we could see the principal public buildings, all of which were encircled with a double row of small gas-lights, which resembled a crown of brilliants. All the columns were wound around with lamps of all sizes and colors. Among the numerous designs was that of the Legion of Honor. It was elevated above the house-top, and the imitation of precious stones of which it is composed was elegant. The River Seine was also festooned all along with garlands upon garlands of lamps. In the Champs Elysées was a square, containing four Chinese towers, composed of different-colored lamps. Circle was within a circle, till you thought you could see almost into futurity. These four pagodas were connected with triple garlands of lamps of all colors, caught up at equal distances by bunches of lamps of different forms. The Invalides, however, was the most beautiful, but it requires a more skillful pen than mine to give a description of the decorations. Near the Invalides were also the fireworks, which were magnificent. Fountains, rockets, wheels—in a word, every thing that art could produce in that line, was there exhibited that evening. As for the spectators, there must have been at least one million present. Men, women, and children all thronged to see the fireworks, and for hours the principal street was nothing but a sea of heads.

There were guards and policemen placed at different points, and, notwithstanding this almost incredible number of people, there were no fights, no picking of pockets, no disturbance. All was quiet and well arranged. Every one seemed to enjoy the sight, without having before his eyes the continual fear of being robbed. The free approval and calm behavior of the people showed that they are accustomed to such grand sights. What struck me as strange was, that the Emperor was not in Paris at this grand celebration, but remained at his country seat at St. Cloud.

August 16.—This evening at five o'clock we left Paris for Cob-

lentz. Daylight lasted but three and a half hours, so I saw but few of the villages through which we passed. There are many stone-quarries on the way between Coblentz and Paris. From these quarries the stone is transported to Paris either by rail, river, or canal.

In this district the soil is much richer than in Dijon, but the wine is not celebrated, as the ground is entirely planted with grain, and the laborers raise only enough grapes for their own use.

I noticed that a great deal of hemp is cultivated in this part. It looks very well, as also do the clover-fields, which one and all are in splendid condition. Poplar-trees are planted in great profusion, and afford a fine shade. The grape-vines on the hill-sides looked very luxuriant, and were devoid of the red spots which I noticed in the districts of Dijon and Beaune. We went too rapidly to judge as to the quality of the crop.

We passed village after village till dark, when we composed ourselves quietly for a nap, but an undisturbed slumber was not attained. No sooner had I fixed myself comfortably, and was already in my first doze, when a stentorian voice demanded "*les billets.*" Arousing myself with difficulty, I fumbled in every pocket, until, by chance, I reached the right one which contained the tickets, which the conductor glanced at and returned. This process was renewed every hour, till finally I was worked up almost to desperation. But fortunately this, as all troubles, had an end, and we reached Cologne, where we changed cars for Coblentz. I forgot to say that, upon reaching the Prussian borders, we were hustled out into the Custom-house, where we were very civilly treated by the officers, only going through a pretense of examination.

August 18.—I took a carriage, and went to Ems with my family. The road leading there winds along the banks of the river, and is at the foot of the mountains, which are all planted with vines; but the whole mountain being nothing but slate, every few rods there are high rock walls which form a sort of platform, and on these are planted vines, which look well, but the wine is inferior, as the soil is slate-rock and sand. We passed several large iron factories on the road to Ems, where we arrived at half past nine o'clock.

Ems is the property of the Duke of Nassau, and yields him an annual income of two millions of dollars. Every thing is very finely arranged, and not costly for a bathing-place.

We took a promenade after dinner, and passed into the Casino, where there are two large gaming-tables, around which were crowded numerous spectators and betters, among whom I observed several ladies, throwing down their coins on the red or black. I was told that, a short time since, a count lost all he had and blew his brains out, while a more lucky individual broke the bank and won 52,000 thalers. But I soon left, as I did not expect to be lucky like the latter, nor want to fare like the former.

August 19.—A beautiful strain of music awoke me from a most pleasant sleep to a most beautiful morning. The band, composed of forty musicians, paid by the Duke, plays every morning from six to eight o'clock. Hastily putting on my clothes, I went upon the promenade, which was crowded with genuine patients, and pretty patients who wished to attract attention by their apparently delicate health, but in reality showed themselves to make a good match. I was much amused by the various manœuvres of the mammas, who were on the *qui vive* not to let their inexperienced daughters make a blunder.

The day was passed in visiting the grounds and neighborhood, and in forming acquaintances. We met here our sincere and good old friend, Dr. Precht, with whom an appointment had previously been arranged by telegraph. He was accompanied by his lady. Our meeting proved a mutual gratification. After partaking of a good dinner, accompanied by a few bottles of the best wine the cellar of the Duke could furnish, we passed the remainder of that day admiring the beautiful promenades, rapt sometimes in the enticing charms of music, or beholding with admiration the loveliest beauties of all nations who gather here.

August 20.—In the morning, at six o'clock, we were all up to take a donkey-ride and see the surrounding country. The custom here is to ride donkeys. Those destined for ladies have on them a kind of arm-chair saddle, well wadded, open on one side, and with a back on the other. The color of the cover is a gay red, and the whole concern is very convenient. This is placed on a small donkey, hardly larger than a Newfoundland dog, who trots off with his burden with the greatest seeming ease. The ladies were delighted with their long-eared chargers and their easy gait.

Each donkey has a driver, who remains close behind the animal to quicken its speed or guide it. This latter operation is done by twisting the donkey's tail to the right or to the left, just as he is wished to go. Our party was composed of three ladies, myself,

and Arpad. We men rode mules, which, in my estimation, were not as good as the donkeys, inasmuch as these, with the ladies, were always ahead of us, and it was only with the continual exertion of our heels and the application of the driver's stick that we could catch up with them.

Our drive was toward a valley called the "Valley of the Swiss." The road ascends to the top of a well-timbered mountain, and then descends into the above-mentioned valley. On the side of the hill, before descending into the Swiss valley, is the family vault of Count Stein, minister of the King of Prussia, and a celebrity of the time of Napoleon the First. This vault, which also holds several members of the family, is of stone, and is a building of simple construction. It is surrounded by a small garden containing several pine-trees, and which itself is encircled by a stone wall. A woman came and opened, first, the gate of the wall, and then the iron door of the vault. After we had seen all that was to be seen, which was a couple of sculptures and as many inscriptions, we left the resting-place of the dead, and wound our way down the narrow path into the valley.

The path was so steep and so narrow that we were obliged to dismount and descend on foot. On our way down we passed several small grist-mills, whose working force was given by a small stream. The water runs along in a ditch, and is brought in a wooden trough, one foot wide and about six inches deep, over a bucket-wheel. I examined one of these wheels: it was twenty-eight feet high and one foot wide; its bucket holds about a gallon and a half of water. The water running was but one and a half inch deep and twelve inches wide. The stones and inside arrangements are all very primitive. As for the construction of the wheel, round the axle is built a cog-wheel, the cogs being on the side, and turning a small spindle with seven horizontal rods, this spindle, in its turn, turning the stone. Much improvement might be made in the stone and all the other arrangements. I was informed by the miller that he makes about ten bushels a day. The flour is bad, and would not be marketable with us.

We passed several silver mines; they are being worked with good advantage to the proprietors. I intend to visit at least one of the smelting establishments. Perhaps they contain some new improvements by which Washoe might derive some benefit.

We at last arrived home, much pleased with our donkey-ride,

but less so with the information which I gathered; the land is poor, the people poor; the mountains are not even fit for the vine culture. The country gives but meager earnings to its inhabitants, and, were it not for this bathing-place, they would fare still worse. Ems brings together thousands of people each year from far and near, either for pleasure or to partake of its mineral waters, whose healing virtues have a wide reputation. The tax on agricultural lands in the Duchy of Nassau is six dollars on the thousand. Mechanics pay a much larger tax.

We went this evening to the theatre. The acting was pretty good. There was present a fine array of ladies. The diamonds sparkled, the pearls, rubies, etc., rivalized with each other, but the captivating eyes of the ladies were above all the diamonds and pearls.

August 21.—Long before the beautiful band of music began to play I was up writing letters to my correspondents in Europe, and then continued my journal. Having not much to write from the doings of yesterday, I finished in the forenoon, and then received several visits. Having been invited to dine with Dr. Precht, myself and family went to dinner. During the day I sent some letters and papers to Count Wass, also to Mr. Grisza. In the evening I received Mr. Ordödy, a Hungarian nobleman, and his lady. During the evening we received several other visits, after which we went for an hour to the ball. Returning from the ball, I read some books on wine and wine-growing, after which I prepared for my departure to the upper parts of the Rhine.

August 22.—I started in the morning for Coblentz with Dr. Precht and Arpad. Arrived in Coblentz, I called on the banker to whom I had a letter of credit, but, to my surprise, he informed me that he had received no notice from Hentsch and Lutscher, consequently he could not pay me any money on my letter of credit. What was to be done? I had but three florins in my pocket, and a bill for five days' living for myself and family in Ems. I at once telegraphed to Frankfort, where the same letter of credit was addressed to another banking-house. From this house I received the answer that they had been notified from Paris, and so I at once started for Frankfort.

From Coblentz to Frankfort by railroad it takes five hours fifteen minutes, and the fare in the second class is two and a half thalers per seat. In Germany only the nobility and higher classes, or, to use a colloquial term, the *Big-bugs*, travel in the first

class. The railway carried us past many celebrated vineyards; but, as the money was at *low tide* in our pockets, we were forced to delay our investigations till high tide, which we hoped would take place, as usual, in twenty-four hours or less.

This money affair would have been more annoying than it really was had it not been for Dr. Precht, who furnished me with twenty-five florins to proceed on my way to Frankfort. It was altogether brought on by the carelessness of the corresponding clerk of the house Hentsch and Lutscher. I purposely put this little accident in my report to warn my fellow-citizens who travel never to let their purse run down low enough to prevent themselves from reaching the next-named place on their letter of credit. A letter of credit, in traveling, is preferable to cash, as this may be lost or be stolen; besides, the constant change of money in the different countries constitutes a certain loss, not taking into consideration that *changers* are never over-honest people. Not only, then, is a letter of credit safer, but also much more preferable.

On the road from Coblentz I opened a conversation with a clergyman, who gave me some information on vines and their varieties. I also had a conversation with the proprietor of a vineyard, who is himself manufacturing wine. He recommends to me in very high terms the hydraulic press, to press out the juice from the pulp of the grapes. He added that this new press, only introduced five years ago, works admirably well, and that all those who make any progress in wine manufacturing introduce it into their establishments. I asked him why they had abandoned the cylinder crushers, and again adopted the old method of stamping with the feet or with wooden pieces? I was answered that cylinders crush more or less of the stems, which, containing a bitter juice, communicates the flavor to the wine, destroying some of its bouquet, and making it less palatable. In regard to nurseries, the general answer I receive is, that there are none of any consequence in the neighborhood. The trees on the road have no fruit at all. Some attribute this to the frost, others again to the last year's crop, which was extraordinarily heavy, and consequently spoiled this year's. I told them that in America we had a mode of regulating, to some extent, the bearing of our trees by root-pruning them. They listened attentively, but I saw by their smiles, which were hardly suppressed, that they very much doubted my statements. The people here, in general agricultural knowledge, are much behind ours of the same class. We arrived in

Frankfort at half past ten in the night, where we took a beefsteak, and then went to bed.

August 23.—I, as usual, wrote my journal in the morning. After nine o'clock I went with Arpad to my banker Metzler, who paid me the required money, and kindly offered me his services and letters of introduction to several proprietors of large vineyards—among others, one at Johannisberg. I accepted his offers with thanks.

From here we went to the American consul general, Mr. Ricker. Inquiring about Mr. Ross Browne, I found that he was absent, traveling in Norway, but was expected back daily. From the consul's we went and took a walk around the city for half an hour, then returned to the hotel to write our correspondence, etc. We were not long thus occupied before Mr. Howard, son of General Volney Howard, of San Francisco, called upon us. This young man is studying medicine in Europe. I invited him to dine, and after dinner he went with us to *Hochheim* by railroad.

CHAPTER IV.

HOCHHEIM, STEINBERG, AND JOHANNISBERG.

Hochheim.—Mr. Dresel.—The Champagne Manufactory.—Mr. Lembach.—His Cellar.—His Method of Wine-making.—Different Wines from the same Grape.—The Barrels.—Sulphuring the Barrels.—Price of Wines.—Regulations for Gathering the Grapes.—Visit to the Champagne Manufactory.—Mr. Hummel.—Wiesbaden.—Professor Medicus.—The Kurhaus.—The Gambling Rooms.—Dr. Thomä.—Biberich.—The Chief of the Steinberg Vineyards.—The Steinberg Vineyards.—Mode of Cultivating the Grape.—The Farm-yard.—Eberbach.—The Wine Cellars.—Tasting Wines.—Bouquet of Old and New Wines.—How to taste fine Wines.—Assorting the Grapes.—Manufacturing the Wine.—Large and small Barrels.—Requisites for making good Wines.—The Presses.—Visit to Johannisberg.—The Soil of the Region.—Vineyards not Sold.—Their Value.—Palace of Johannisberg.—The Vineyard.—The Cellars.—The Johannisberg and Steinberg Wines.—Rivalry between them.—The Superiority sometimes accidental.—A lucky Stroke.—Prices the same.—Last Glasses of Johannisberg.—Geisberg.—The Experimental Gardens.—Results of Experiments.—High Trimming and low Trimming of Vines.—The School of Agriculture.—Exchange of Seeds.—Departure for Frankfort.—Report of Wine Auctions at Eberbach.

In an hour's travel we arrived at Hochheim, where, after going to an inn and having our clothes brushed, we set out to see Herman Dresel, Esq., Director of the Champagne manufactory of the Joint-stock Association. The American consul had furnished me with a letter of introduction to Mr. Dresel. He received me kindly, and conducted us through the whole establishment, to describe which, at first sight, would be impossible. This is one of the largest establishments in Germany. It employs eighty men, and makes daily three thousand bottles of Champagne. The capital invested is 1,000,000 *güldens* (about $400,000).* It makes very good sparkling wines, and imitates excellently the French Champagnes. Some of the imitations are really much better than the brands they pretend to imitate. The establishment makes money. Mr. Dresel, who took great pains to show and explain to us each branch separately, invited me to come to-morrow for a closer examination and farther inspection. This gentleman is the brother of Mr. E. Dresel, resident and proprietor of a fine vineyard in Sonoma. I was ignorant of this until I asked the gentleman if he

* The *gülden* (plural *güldens*) or *florin* is equal to about 40 cents.

was not related to a Dresel in California. His answer that he was a brother only brought us closer together in our relations, and we conversed as old acquaintances. The cordial and gentlemanly manner of Mr. Dresel I shall not soon forget.

After spending a couple of hours in the establishment, and tasting some sparkling wine, we returned to our inn. Mr. Dresel joined us at our supper, and we spent an agreeable evening. In fact, we were up until half past eleven, which for a village is a pretty late hour. Parting with Mr. Dresel, with the promise of seeing each other next day for a thorough inspection, I went to bed well contented with to-day's travel and the result of the inspection. I was also contented with the wines we had drunk, for they were very good.

August 24.—After completing my journal of yesterday, we went to take a cup of coffee, then started out with our host, Mr. Lembach, who is a cooper as well as inn-keeper. He has the superintendence of several cellars belonging to persons who do not reside here. We went to a press-house, where we saw two presses with screws; one screw received its resisting point from below, the other from above. Neither of these presses are desirable for imitation.

From here he led us to his own wine-cellar, where he has about seventy *stück*, or pipes, each holding about two hundred and fifty gallons of wine. He gave us to taste wines of three successive years, coming from the same vineyard, forming eleven different wines. These wines were made purely from the Riesling grape; no other variety of grape was in them. The bouquet was fine; the wine clear and excellent. We tasted each wine separately, then compared one with the other. The difference from year to year was remarkable—so great that I was able to distinguish each year. He had first and second quality from the same wine. His mode of making wine is as follows: The grapes are gathered after the dew has dried up, and are carried to the press-house, where the bunches are separated into three, and in some celebrated vineyards into five classes. Each bunch of the first class is carefully divested of the rotten berries, dust, or other impurities. These classes, once formed, are worked separately and always kept apart. The grapes, once separated, are thrown into a crusher, where they run through two cast-iron cylinders. When once through this instrument they are put into a small vat, where they ferment six, eight, and even sixteen hours, but are carefully

pressed down whenever the stems or seeds show themselves on the top.

This mode of fermenting for several hours is not adopted with blue grapes; it is only used for white grapes, and for making white wine from them. To make white wine from blue grapes, you must not ferment them, for that will immediately color it.

The grapes, having fermented for the above-mentioned time, are put in a mass and pressed. In a good year, that is, when the grapes are perfectly ripe and almost raisins, the second or last run makes the best wine. When the grapes are not wholly ripe, the first run, or first pressed juice is thought to make the best wine. The reasons given for this are, that when the grapes are ripened to raisins they contain but little juice, and it is only extracted by a very powerful pressure, and this pressure only comes at the end; but when the grapes are full, and retain all their fluid, the first pressure gives the finest juice, as after it the pressure becomes greater and crushes the seeds and stems, which then discharge some of their bitter contents, which injures the wine. In the first instance, when the grapes are almost raisins, the stones or seeds are also crushed, but they are dry, and are totally void of juice.

The juice is then run into barrels, in the cellar, of one stück (250 gallons) each. These barrels, of course, are only in small vineyards, as in larger ones tuns, containing from two to five thousand gallons, are employed. These vessels, large or small, once filled, remain for a time covered with a clean rag on the bung-hole. They remain thus until March, when they are drawn off into clean barrels. These barrels, if possible, are sulphured a day before being used. If there is a deficiency of barrels, those must be employed which have already been used, but only after having been thoroughly washed and sulphured. The first year the wine is drawn off into new barrels four or five times. It is first drawn off four or five weeks after it is put into barrels, then in two months after, then in three, then in four. In the second year twice will be sufficient; in the third year, once; then once in two years; and after that it may remain in the same barrel until it is bottled. The greatest care should be taken never to leave a vacant space in any barrel holding wine. As our host quaintly said, "You should sooner forget to kiss your wife on returning home than to leave a vacancy in your barrel."

When any barrels are empty, immediately wash them out thoroughly; for each barrel take a sulphur strip, one inch wide and

four long, and burn it in the barrel; then bung it up well, and place it where it will be neither too dry nor too wet, as either extreme will injure it. Three months after, open the barrel, burn half as much as before, then bung it up, to begin again three months after. This is done on all the empty barrels. This operation serves to keep the barrel good and sweet. Should any acid or mould creep into the barrels, take a handful of quick-lime, put it in, pour hot water on it, and wash the barrel well. The price of a new barrel of 250 gallons is 40 *güldens* or florins ($16).

The cleanliness of all the wine-cellars in this country is admirable and most difficult to describe. The vineyards in good bearing years in Hochheim will produce one stück per *morgen* (somewhat less than an acre). The wine per stück sells at from 500 to 3000 florins ($200 to $1200). The wines are splendid, and really delightful to drink.

The authorities are so jealous of the reputation of their wine that no man is permitted to gather his grapes before the time for the vintage is decided by a council. To prevent imprudent men from plucking in the morning, when the dew is still on the grapes, it is forbidden to begin gathering before the large bell of the town has sounded. The same bell also sounds the hour of quitting the vineyard, when every one must cease to gather. Besides these regulations there are many others, as, for instance, a man planting a vineyard has to plant his vines three and a half feet apart, this being considered the best distance for the Riesling grape. Other varieties have different distances allowed to them; the Oestreicher, for instance, must be planted four feet apart, being a grape which produces more wood.

After having examined all the wines, and listened to much valuable information from our good host, we went to the manufactory of sparkling wines to see Mr. Dresel, with whom I had made an appointment. This time I made arrangements to procure all the varieties of vines grown in the neighborhood, and each kind of implement used in the manufacturing of sparkling wine. We once more went through all the cellars and warehouses, Mr. Dresel having introduced me to Mr. H. J. Hummel, superintendent of the wines and cellars. This young man has risen through all the branches of the art until he reached the position which he now occupies. He is a very intelligent man, and, as I am told, is a perfect master of his art. I spoke to him of coming to California to put up for me a similar establishment, if not so great in extent, at

least producing as good wines. He promised to consider the matter, and, if the company gives its consent, he will do so. We spent no less than four full hours in this mammoth establishment, after which we returned to our inn, where Mr. Dresel soon rejoined us. After dinner we parted, Mr. Howard going to Frankfort, myself and Arpad to Wiesbaden, being furnished with several letters of introduction from Mr. Dresel.

We arrived at about five o'clock P.M., and immediately set out to see Professor Medicus, who is a professor in the government School of Agriculture for the education of youth in agricultural knowledge. The professor was absent from town, so we took a stroll in front of the *Kurhaus*, where a band of music was playing. The promenade was full of gay people. This bathing-place is larger than Ems, has splendid buildings, promenades, parks, fountains, etc. It also belongs to the Duke of Nassau, who resides here in winter. The waters are considered very good for curing several diseases.

Following a steady stream of people, we soon found ourselves in a splendid saloon, magnificently decorated, possessing no less than seven immense chandeliers hanging from different parts of the saloon, besides hundreds of other gay burners, all ornamented with ground glass globes. The richness of the furniture was in harmony with the rest of the decorations. The saloon has galleries where the music plays when balls and concerts are given. At the west end of the gallery and building there is a large place decorated with red velvet and gold trimmings for the use of the Duke and family.

In this vast saloon there is a gambling-table, surrounded by men and women, who are players or spectators. From here to the left open three more large saloons, also magnificently furnished and decorated. In the centre of each there is a gambling-table, occupied by players. At two tables they played at rouge et noir, and at the other two at roulette. These places are open to the public, and ladies and gentlemen come in for amusement to play or see the players. They seat themselves around in the rooms on arm-chairs or well-cushioned sofas. Liveried servants are in attendance. No smoking or loud talking is allowed, and hats must be removed from the head. From the last of the three gambling-rooms you enter into a fine large reading-room, where the prominent periodicals and newspapers published in Europe are to be found.

We spent a quarter of an hour in the last playing-room, where we watched a gentleman, who, with the greatest coolness, put up and lost from twenty to forty napoleons ($80 to $160) at a time. We at last went to our hotel, where, after supper, we went to bed.

August 25.—Being Sunday, nothing could be done in the morning except to send a letter to the director, Professor Dr. Thomä, chief of the Giesberg Agricultural Establishment, of which I have already made mention. At three o'clock I received an answer that the director would receive us at four. We accordingly went at that hour, and were received very cordially. After showing my commission, etc., the doctor kindly offered to conduct us to the Institute. He also said it would be better for us to go with him to Biberich, where the Duke is residing, and where also the chief of the wines and cellars is at present. Accordingly, we took a carriage and drove over to the Residence, which is about a mile and a half distant. Arriving there, we were presented to the chief, who was surrounded by gentlemen engaged in the agreeable occupation of drinking wine. The chief is an old gentleman over seventy-five years, unable to walk on account of the gout; still, he received us kindly, and readily gave me all the information I desired. He appointed that to-morrow I should go with his deputy (as he can not leave the house) to the different vineyards and cellars.

In the evening we returned from Biberich, but not before taking a walk in the gardens of the Residence of the Duke of Nassau. The Burg is of ancient architecture, large, standing on the banks of the Rhine, being surrounded on three sides by a fine park containing green-houses, exotics, etc. The trees are old and luxuriant. The town itself is built around the park. It has some fine buildings, but it does not equal Wiesbaden.

August 26.—As I was writing the above, the Director Thomä was announced. He came prepared to accompany me to the various places which the day would permit us to visit. I was much pleased at last to come to a place where the people are punctual, and ready to go to work at seven o'clock. We drove to Biberich. Here the old gentleman received us at the door of his receiving-room, having been assisted there by his valet. He put at our disposal his deputy. With him we proceeded to the celebrated vineyard of Steinberg. This vineyard disputes the superiority of the Johannisberg, and, of course, of the whole Rhine country. It contains 104 *morgen*. Its soil is rocky, and com-

posed of a bluish clay, though the substrata is gravel. The vines are only Riesling; the distance at which they are planted is three feet in the rows, and four feet between the rows. The vineyards last about thirty years, when they are cut out, and the land rests for three years. During the first of these three years they haul some of the manured blue clay, and spread it over the vacant ground about a foot thick. This is done during the summer. Then it is plowed over several times, and clover raised upon it during its years of rest. The average yield of this vineyard is 40 stück, or 10,000 gallons.

Adjoining this vineyard is a farm-yard, which is leased for a period of time, with all the land, to a farmer; but he is obliged to furnish so many loads of manure annually, as it is indispensable to the Steinberg vineyards. I also saw his milk-house, and his cattle, which are not allowed to leave the stable even for watering. He considered his stock very fine, but I have seen much better in California.

From there we went to the old Convent of Eberbach, which is at present partly a state Penitentiary, and the remainder is the cellar of the Duke of Nassau. The deputy master of the cellars opened them, the coopers belonging to the cellars entered, and in about a quarter of an hour we were invited to go in. Upon coming into the cellar a beautiful sight lay before us. Hundreds of lights illumined the room. There were two rows of barrels of 250 gallons each, and upon the end of each was a sperm candle lighted. The barrels being of an equal size, the effect was very fine. This first cellar is about 100 feet long, 40 feet wide, and 25 feet high. It contains several rows of barrels, of which only the two in the centre were lighted. From this we reached a still larger cellar, built square, with the arches resting upon a fine column in the centre. The barrels are placed in a circle, leaving a large space of about thirty feet vacant. Each barrel bore a lighted candle, which added still more to the grandeur of the effect. Around the central column is a table, on which were placed about forty glasses for tasting the wine. From this cellar there is still another, which also was lighted. It is about 100 feet in length.

Upon returning to the middle cellar we stopped at the table before-mentioned; the deputy then ordered wine to be brought from the year 1822 to 1859: beyond this year the wines are not presentable. The reader may imagine with what caution we put ourselves to the task of tasting. To describe the wines would be

a work sufficient for Byron, Shakspeare, or Schiller, and even those geniuses would not do full justice to them until they had imbibed a couple of glasses full. As you take a mouthful and let it run drop by drop down your throat, it leaves in your mouth the same aroma as a bouquet of the choicest flowers will offer to your olfactories.

The older a wine becomes, the less grows its bouquet, but it grows more and more delicate. A young wine of four years old has this bouquet in a very great degree; but as it becomes older it loses it, gaining instead a more delicate but more penetrating taste; it now communicates to the palate slowly but surely its perfume.

After having tasted many, we finally concluded by drinking a couple of glasses of the finest wine mortal can imbibe. I may here remark to those who are not initiated in the manner of *tasting* wine, that you do not drink it, but take a few drops on your tongue, and if it is old, let a few drops trickle slowly down your throat. If the wine is of little value, you keep it a few moments in your mouth and then throw it out. The reason of this is that a fine old wine will, by a few drops, give you the entire taste, whereas it is necessary to take a large mouthful of the inferior wine in order to be able to judge of its quality. The Duke every year causes a public auction to be held; then wines of three and four years old are sold. Older wines are not sold at public auction, but have a fixed price, which would astonish some of my readers. Again, there are wines which can not be bought for any price.

The wines grown on different parts of the domain are kept in this cellar. The grapes are picked by women and children, who have wooden tubs with leathern straps, so that they may be carried on the back. When these tubs are full, they are taken to a place where there are persons who classify the grapes; that is, they take all the finest bunches and lay them on one side, then the next finest, and so on; from these latter sorts the second and third class wine is made. From the first class grapes (which are allowed to become like raisins before they are picked), the finest berries are cut out and placed in a large earthenware dish; from these selected grapes is made the first class wine called the Auslese ("Select"). These grapes are trodden out with boots made for that purpose. They are pressed in a press of their own, so that no other juice may be mixed with theirs. The juice is then put

into a clean barrel and left for fermentation. The bung-hole is covered with an earthenware funnel, which is half filled with water, so that the gas bubbles up through the water, but lets no air reach the wine. This precaution is used with all wines, none being fermented with bung-holes open.

The first class bunches, from which the finest berries have already been picked, are then trodden, pressed, and produce the second quality. To this is also put that juice which is pressed from the best of the second and third class bunches; that is, from each of the bunches the finest berries are cut out, as from the first class.

Seeing in the cellar barrels containing but 170 to 250 gallons each, I asked whether they considered the wine better in a small barrel or in a large one, say of 2000 gallons.

The answer was that the wine is much better in a large barrel, as the fermentation then is more uniform. But they are troubled to fill one of the large barrels with wine of the first quality. The Steinberg vineyard of 104 *morgen* will, in a very good season (which is once in about ten years), fill with first class wine one stück, or 250 gallons. In other years it is with difficulty that they can fill a half stück.

It is now admitted by every one here that fine wine-making depends as much on the careful selection and classification of the grapes and their quality as upon the climate and soil. Even in places where very inferior wine was raised formerly, now, by careful selection of grapes, care, and attention during the fermentation, fine wine is made, which frequently sells for 1500 to 2000 *güldens* per barrel. The above has been proved by the experience of the veteran officer of the cellars, who some time ago celebrated the fiftieth year in the service of his government, exclusively in the superintendence of vineyards and vines. Having begun as cup-bearer, he rose by degrees to his present position. With regard to the fermentation, I was told that the wine will ferment from ten to twelve days. The warm or cold weather has much to do with the length of time required for the fermentation.

The grapes are generally picked at the end of November and beginning of December, often when the snow is two, and even three inches thick on the ground; but if they are caught by snow or rain, they lose much of their beauty, and the wine its flavor.

In the press-house there are about thirty presses. They consist of a simple screw, which has two rings to put in the lever end.

This lever is a long oak pole, within fifteen feet of the press. There is an upright on a pivot. This upright has holes made through, long enough to receive levers to turn the same. It acts altogether like a capstan on a vessel. The presses are simple, and susceptible of great improvement. After inspecting every thing in the cellar and press-house, we went to take a country dinner in the cooper's room. It was served up by a rosy-cheeked girl. After giving her two thalers, and the cooper who served the wine in the cellar five thalers, we left for Johannisberg, the palace of the Prince Metternich.

The palace of the prince is about two hours' drive from Eberbach. The country lying between these two celebrated vineyards gradually rises from the River Rhine. With the exception of Steinberg and its immediate vicinity, the soil is a very red clay, heavily intermixed with gravel. This is the same soil as Sonoma possesses by thousands of acres, and in other parts of California there are millions. Of course, every spot of earth is planted here; and so economical are they with the ground, that the walks are not more than three or four feet wide. The vineyard lots are small, from a quarter of an acre to two acres. I asked the director the price of one *morgen*. He answered that they have no price, as it is all owned by rich people of all countries, none of whom will sell. For many years there has been no instance of a sale. If a division takes place among heirs, and the vineyard is so small that it can not be divided, the *morgen* is valued at 20,000 *güldens*, and the retainer of the vineyard has to pay over to the other heir his part of the money.

After passing several prosperous villages, we arrived at last at the palace. The courteous steward received us very kindly. Mr. Joh. Herzmansky has been for many years the manager of this beautiful property. The palace is about three miles from the River Rhine, and is situated upon an elevation. As you step upon the terrace in front of the palace, a grand and beautiful view meets your gaze. The Prince may boast of the view from his palace, as I can from my ranch in Sonoma; or, rather, I may boast of having scenery equal to that of the Prince Metternich. It is true that I have no River Rhine, but in its place there lies the St. Pablo Bay.

The vineyard encircles the palace and contains sixty-five *morgen*. Some spots are newly planted; some lie fallow, as here also the vines will produce for thirty years only, when they are

cut out, and the ground suffered to rest for three or four years, well manured, and then replanted.

Here the vines look very well, having a good healthy color, and are kept clean, no grass being visible. The grapes show signs of ripening. They are all of one kind—the Riesling. There are several varieties of table grapes in the yards and around the walks in the garden, but in the vineyard there are no varieties.

We were then invited to walk into the cellars, which are under the palace. After going down thirty feet we entered the first cellar, which was lighted in the same manner as that of the Duke previously described, with the exception that it is not round. The vaults are all about forty feet wide and twenty high, arched with stone. This domain originally belonged to the priests, and was a monastery, but Napoleon drove out the monks and presented their abode to Kellerman, one of his generals. After the deposition of Napoleon the Congress of Vienna presented Prince Metternich with this domain for his services. The deceased and the present prince have spent much in beautifying this truly royal domain.

We tasted many wines, which *must* be tasted to know their magnificence, for it is beyond the power of description. These wines, like those of the Duke of Nassau, are occasionally sold at public auction, but at such exorbitant prices that we poor republicans would shudder as much to drink such costly liquid as if it was molten gold. There is a pardonable rivalry existing between the officers of the Duke of Nassau and those of Prince Metternich. Those of the Duke contend that the Steinberg gives the best wine, whereas those of the Prince say the Johannisberg is better. This divided opinion is held all over the country among the citizens. Both vineyards have the same kind of grape, the Riesling, so it is but the location and the soil which can be in favor of the one or the other. The mode of making the wine is the same, but the grapes are not always picked at the same time; for instance, Mr. Herzmansky, in 1849, plucked his grapes a week earlier than the master of the cellars of the Duke. During that week some snow fell, which watered the Duke's grapes, and, though he made magnificent wine, still it is not considered as good as that of Johannisberg. This lucky stroke of his superintendent benefited the owner of Johannisberg many thousand *güldens.* From the first-selected berries they made one barrel of 175 gallons, for which they refused 12,000 *gülden.* The wines are here sold after being four

days or three years old. The prices are almost the same as those at Eberbach.

Beyond the first cellar is another, built in the same shape as the first. We did not enter it, as it is only used for fermenting the new wines, and of course it is at present empty. The cellars extend all around the large palace. After we had finished tasting the wines, our host made us empty a couple of glasses to the prosperity of the vine culture in California. After doing this it was with difficulty that we could leave our courteous host, who insisted upon our drinking still more; but I summoned up virtue to decline, though I am afraid it will be many a long year before such precious nectar will again moisten my lips. The general opinion is that wines will attain their greatest excellence in from five to ten years, and after that they lose much of their splendid and acquired bouquet.

On leaving the cellar, and presenting the cooper with sixteen thalers, we entered the carriage and drove toward home, passing Biberich, where we left Mr. Victor. We arrived in Wiesbaden quite late in the night, after having had the honor of tasting the finest wines in Europe, for to my palate there are no finer than the above-named.

August 27.—This morning Mr. Thomä called, and stated that he had ordered the list of sales for the last three years to be made out. And now he was ready to take me to Geisberg, where the agricultural Experimental Gardens are located. Here there is a vineyard of about 300 kinds of grapes which are tested. The principal care is used in testing the mode of pruning, and raising the vines low or high, setting them in rows or squares, staking them, or training them over wires in trellis form, and the like. Many experiments are made upon the vines. Each row is kept apart, raised, pruned, trimmed separately. The progress of the vine and grape is closely watched by experienced chemists; the leaves, wood, and grape are chemically analyzed to see what difference is made by the different modes of cultivation. The grapes are gathered on the same day, divided into three classes from each row; then they are equally tested, from time to time, with the alcometer. In this way, from year to year, this systematic experimenting goes on. I was told that, so far, the low trimming, or, in other words, vines raised just high enough to prevent the grapes from hanging on the ground, is the best mode of raising them. This proves the truth of my experience with regard to

California vines, with the exception that we need not fear to have our grapes upon the ground, as there are no summer rains with us. In the garden hops, grains, and vegetables are planted. The Agricultural School is supported by the State. It possesses models of all utensils invented here, a fine agricultural library, and collections of grains, seeds, and objects of Natural History.

I presented the Director with two volumes of our State agricultural reports. I found here a copy of the Patent Office reports of 1846. I promised to send some later numbers, and I also made arrangements to exchange seeds, etc., with the Institute. After examining every thing, and taking down the names of various books on wine culture, I returned to my hotel, where I wrote a letter of thanks to Director Thomä and the chief master of the cellars. I thanked them in the name of our government; for it was to California I owed the distinguished reception I met as her commissioner. I then packed up my things, and, after parting with my new acquaintances, and especially from Director Thomä—to whom I would here again express my sincere thanks for his courtesy, and the information he so freely and kindly furnished—I took the cars for Frankfort, having previously dispatched my son to Ems to escort his mother and sister to Mayence, where I expected to meet them.

SALES OF WINE BY AUCTION AT EBERACH.

[The quantity in the barrel is given in *Maase*, the price in *Florins*. The *Maas* is $\frac{5}{12}$ of an American gallon—two and $\frac{2}{5}$ *Maase* equaling a gallon. The *Florin* is worth 40 cents.]

SEPTEMBER 7, 1858.—VINTAGE OF 1857.

No.	*Vintage.*	*Quantity.*	*Price.*	*Purchaser.*
5	Hattenheimer	600	1070	P. Espenschied, *Rudesheim.*
7	"	606	1430	Frz. Müller, *Eltville.*
9	"	605	1365	Walther, Brothers, *Mayence.*
11	"	598	1555	Frz. Müller, *Eltville.*
13	"	603	1660	" "
15	"	593	1495	Feist, *Frankfort.*
17	"	603	1805	Deinhard, Fordan, *Coblentz.*
20	Grafenberger	296	1000	M. Müller, *Eltville.*
21[b]	"	296½	1045	C. de la Roche, *Hattenheim.*
23	Marcobrunner	590	2000	Michels, *Cologne.*
25	"	601	2105	Deinhard, Fordan, *Coblentz.*
27	"	606	2905	P. Espenschied, *Rudesheim.*
29[b]	"	293	2205	Gogel Koch, *Frankfort.*
31	Steinberger	592	1800	C. Lautern, *Mayence.*
33	"	595	1960	Deinhard, Fordan, *Coblentz.*
35	"	600	2000	Michels, *Cologne.*
37	"	593	2685	Masbach, Brothers, *Mayence.*
41	"	596	2825	Fost, *Rudesheim.*
43	"	597	2625	H. Becker, *Ems.*

No.	Vintage.	Quantity.	Price.	Purchaser.
45	Steinberger	604	2220	Ch. Giessen, *Cologne.*
47	"	585	2715	Deinhard, Fordan, *Coblentz.*
49	"	590	2920	Valkenberg, *Worms.*
51	"	608	3250	F. Bertram, *Wiesbaden.*
53	"	601	3225	Feist, *Frankfort.*
55	"	595	3935	P. A. Mumm, *Cologne.*
57	"	604	3305	Behrends, Brothers, *Frankfort.*
59	"	606	3260	F. Berthold, *Frankfort.*
61	"	599	3710	C. de la Roche, *Hattenheim.*
63	"	606	3510	Volkenbach, *Worms.*
65	"	601	3715	Sachs, *Coblentz.*
67	"	605	3450	F. Müller, *Eltville.*
69	"	598	3705	Deinhard, Fordan, *Coblentz.*
71	"	597	3770	Michels, *Cologne.*
73	"	599	3600	Dilthey, *Rudesheim.*
75	"	593	3810	M. Müller, *Eltville.*
77	"	580	4050	Lautern, *Mayence.*
79	"	596	4155	M. Müller, *Eltville.*
81	"	606	4220	Dubois, *Mayence.*
83	"	599	3595	C. A. Giessen, *Frankfort.*
85	"	600	3815	B. Meier, *Mayence.*
87	"	600	4500	Manskopf, *Frankfort.*
92	"	304	2475	Lobus, *Geisenheim.*
93	"	600	5470	P. A. Mumm, *Cologne.*
94[b]	"	290	2130	Gogel Koch, *Frankfort.*
98[b]	"	293	3090	Manskopf, *Frankfort.*
99[b]	"	296	2710	B. F. Mayer, *Mayence.*
	Steinberger (*Vint. of* 1846.)	295	6000	The King of Hanover.

APRIL 12, 1860.—VINTAGE OF 1858.

No.	Vintage.	Quantity.	Price.	Purchaser.
1	Steinberger	660	660	M. Müller, *Eltville.*
2	"	600	560	G. Birlenbach, *Wiesbaden.*
3	"	594	805	H. Bertram, *Wiesbaden.*
4	"	600	635	Lautern & Son, *Mayence.*
5	"	590	770	M. Hansemann, *Bonn.*
6	"	594	805	Menges & Schmitz, *Mayence.*
7	"	599	850	Hurter, *Coblentz.*
8	"	585	815	Menges & Schmitz, *Mayence.*
9	"	605	910	Abreich, *Mayence.*
10	"	605	810	Lautern & Son, *Mayence.*
11	"	589	950	M. Müller, *Eltville.*
12	"	592	900	" "
13	"	593	1035	Menges & Schmitz, *Mayence.*
14	"	600	990	Pabstmann, *Castel.*
15	"	602	900	M. Müller, *Eltville.*
16	"	596	1035	Deinhard, Fordan, *Coblentz.*
17	"	590	1050	Liebrecht, *Ruhrort.*
18	"	592	1225	Manskopf, *Frankfort.*
19	"	598	1250	Fost, *Rudesheim.*
20	"	600	1155	Eisenberg, *Castel.*
21	"	592	1240	F. Müller, *Eltville.*
22	"	595	1260	Valkenberg, *Worms.*
23	"	587	1465	M. Müller, *Eltville.*
24	"	591	1485	" "
25	"	295	1015	H. Holler, *Hochheim.*
26	Grafenberger	290	630	J. Friedmann, *Mayence.*
27	"	300	720	Anthes, *Wiesbaden.*
28	Hattenheimer	603	980	Eisenberg, *Castel.*
29	"	590	1010	F. Müller, *Eltville.*
30	"	586	1210	Fung, *Rudesheim.*

No.	Vintage.	Quantity.	Price.	Purchaser.
31	Hattenheimer	597	1325	Hoffman, *Mayence.*
32	"	603	1510	Valkenberg, *Worms.*
33	Marcobrunner	600	1205	P. Wilhelm, *Wiesbaden.*
34	"	595	1415	B. F. Mayer, *Mayence.*

FROM THE VINTAGE OF 1857.

No.	Vintage.	Quantity.	Price.	Purchaser.
1	Hattenheimer	605	960	M. Müller, *Eltville.*
2	"	592	1395	Deinhard, Fordan, *Coblentz.*
3	"	598	1260	Ring, Brothers, *Biberich.*
4	"	589	1705	Deinhard, Fordan, *Coblentz.*
5	Marcobrunner	598	1500	P. Wilhelm, *Wiesbaden.*
6	"	594	2080	Manskopf, *Frankfort.*
7	"	592	2420	Valkenberg, *Worms.*
8	Steinberger	599	1625	Lautern, *Mayence.*
9	"	598	1950	F. S. Crass, *Erbach.*
10	"	605	1690	W. Kroschel, *Hochheim.*
11	"	600	2135	Eisenberg, *Castel.*
12	"	592	2015	Walker, Brothers, *Mayence.*
13	"	594	2170	Lautern, *Mayence.*
14	"	590	2335	Abreich, *Mayence.*
15	"	596	2380	Brucker, *Frankfort.*
16	"	600	3005	H. Bertram, *Wiesbaden.*
17	"	596	2430	F. S. Crass, *Erbach.*
18	"	590	2415	Manskopf, *Frankfort.*
19	"	589	2655	" "
20	"	592	3105	F. Müller, *Eltville.*
21	"	586	2710	Lautern, *Mayence.*
22	"	596	2505	W. Kroschel, *Hochheim.*
23	"	595	3015	F. Müller, *Eltville.*
24	"	596	2570	F. Jann, *Geisenheim.*
25	"	605	3190	Mumm, *Frankfort.*
27	"	597	3480	Manskopf & Falkenburg.
28	"	303	1710	W. Kroschel, *Hochheim.*
29	"	292	1800	Pabstmann, *Castel.*
30	"	294	1810	Hürter, Sohn, *Coblentz.*
31	"	290	1810	Wallot, Brothers, *Oppenheim.*
32	"	293	1855	" " "
33	"	290	2360	Lautern, Sohn, *Mayence.*
34	"	292	2415	G. Philippi, *Breslau.*
35	"	294	2465	H. & J. Espenschied, *Coblentz.*
36	"	308	2705	Manskopf, *Frankfort.*
37	"	297	3000	Mumm, *Frankfort.*

MAY 14, 1861.—VINTAGE OF 1858.

No.	Vintage.	Quantity.	Price.	Purchaser.
1	Steinberger	607	1360	J. Strauss Söhne, *Mayence.*
2	"	588	960	J. B. Hartmann, *Wiesbaden.*
3	"	596	1000	J. Liebrecht, *Ruhrort.*
4	"	594	1100	Specht, *Mayence.*
5	"	598	1180	J. Liebrecht, *Ruhrort.*
6	"	602	1330	Leyenthal and Mosler, *Coblentz.*
7	"	600	1505	H. & G. Hirsch, *Mayence.*
8	"	600	1505	F. Jann, *Geisenheim.*
9	"	585	1460	Gebr. Walther, *Mayence.*
10	"	593	1850	Rosenstein, *Wiesbaden.*
11	"	587	2060	J. Bertram, "
12	"	605	2065	S. W. Krausser & Co., *Mayence.*
13	"	596	2900	Manskopf & Sarasin.
14	Füllwein			
15	Hattenheimer	590	1300	Gebr. Feist, *Frankfort.*

No.	*Vintage.*	*Quantity.*	*Price.*	*Purchaser.*
16	Hattenheimer	592	1450............	F. Jann, *Geisenheim.*
17	"	296	1000............	Potthof & Söhne, *Kreutznach.*
18	"	297	1155............	Manskopf, *Frankfort.*
19	"	294	1230............	Gebr. Masbach, *Frankfort.*
20	Marcobrunner	590	2005............	Dubois, *Frankfort.*
21	Marcobrunner	297	1235............	F. Müller, *Eltville.*
22	"	284	1320............	Valkenberg, *Worms.*
23		296	1600............	Ried, *Frankfort.*

FROM THE VINTAGE OF 1859.

No.	*Vintage.*	*Quantity.*	*Price.*	*Purchaser.*
24	Hattenheimer	292^5	480............	Sarbach & Gutmann, *Mayence.*
25	"	598	1120............	Menges & Schmitz, *Mayence.*
26	"	595	1110............	Rehms, *Leipzig.*
27	"	605	1415............	Manskopf, *Frankfort.*
28	"	595	2010............	Biermann, *Bielefeld.*
29	"	600	2290............	Menges & Schmitz, *Mayence.*
30	Marcobrunner	600	2550............	S. M. Seligmann, *Frankfort.*
31	"	595	2650............	Sarbach & Gutmann, *Mayence.*
32	Steinberger	606	1480............	C. Ettinghaus, *Hattenheim.*
33	"	596	1100............	P. F. Werner, *Neudorf.*
34	"	595	910............	F. Jann, *Geisenheim.*
35	"	600	900............	M. Hansemann, *Bonn.*
36	"	604	1100............	Valkenberg, *Worms.*
37	"	601	985............	Cantor & Sohn, *Mayence.*
38	"	594	1310............	Kleeman, *Mayence.*
39	"	601	1420............	Leventhal & Masler, *Coblentz.*
40	"	595	1265............	C. Ettinghaus, *Hattenheim.*
41	"	600	1130............	Diehl, *Mayence.*
42	"	596	1485............	C. Ettinghaus, *Hattenheim.*
43	"	607	1150............	Gebr. Masbach, *Mayence.*
44	"	608	1670............	Gebr. Feist, *Frankfort.*
45	"	605	1465............	Jann, *Geisenheim.*
46	"	594	1420............	Beckhardt & Söhne, *Kreuznach.*
47	"	594	1455............	Deinhardt & Fordan, *Coblentz.*
48	Füllwein			
49	Steinberger	605	1275............	Biermann, *Bielefeld.*
50	"	600	1420............	Pfeiffer, *Heidelberg.*
51	"	588	1320............	Jann, *Geisenheim.*
52	"	585	2005............	Manskopf, *Frankfort.*
53	"	597	1670............	Gebr. Feist, *Frankfort.*
54	"	598	1600............	Crass, *Erbach.*
55	"	592	1890............	H. & C. Espenschied, *Coblentz.*
56	"	600	2465............	Biermann, *Bielefeld.*
57	"	597	1755............	Gebr. Behrends, *Frankfort.*
58	"	594	2345............	Deinhardt & Fordan, *Coblentz.*
59	"	600	2680............	W. Bürkert, *Biberich.*
60	"	585	2425............	Cantor & Sohn, *Mayence.*
61	"	594	2780............	Manskopf, *Frankfort.*
62	"	598	2705............	Gebr. Masbach, *Mayence.*
63	"	591	2870............	Deinhardt & Fordan, *Coblentz.*
64	"	606	3115............	Gebr. Behrends, *Frankfort.*
65	"	602	3415............	Manskopf, *Frankfort.*

CHAPTER V.

GERMANY, THROUGH SWITZERLAND, TO ITALY.

From Frankfort to Mayence.—The Russian Lady and her Maid.—Her extra Baggage.—Our Talk about California.—European Ideas of our State.—Hints for the Press of California.—Wash dirty Linen at Home.—Chronicle on Normal Progress rather than on exceptional Crimes.—Mayence to Heidelberg.—Tobacco.—Heidelberg.—Nursery at Wiesloch.—Carl Brunner.—His Nursery, Gardens, and Vineyard.—His Wine-press.—The great Tun at Heidelberg.—Start for Basle.—Notes by the Way.—Hemp.—Manuring by Burning.—From Basle to Geneva.—Neufchatel.—The Swiss and American Lakes.—Geneva.—Passports for Italy.—Americans in Geneva.—Departure for Italy.—The Road and the Country.—St. Jean de Moreno.—The Tunnel.—Crossing the Summit.—The Descent.—Arrival at Turin.

August 27.—On entering the cars at Frankfort for Mayence, I was much amused with a lady from Russia, in the same car with me, returning from the baths at Wiesbaden. Her servant-girl, not speaking a word of German, soon got into trouble about the innumerable boxes, packages, bundles, umbrellas, parasols, and many other things placed in her charge, all of which were to be taken into the cars, as this formidable pile contained but a few little extras to be kept near at hand. The main and heavy baggage, to the amount of fourteen tickets, which I saw, was already in the baggage-car. The bundles had to go into the car, and after the seat and the net-work on the top were filled, in came the mistress herself, laden with a goodly number more, which she piled up above her and in her lap. The conductor rushed forward, telling the maid to go in. She gesticulated, and talked to him in Russian, he not understanding a word of her language. She was at last put in the place she was to occupy, the conductor taking her by the arm and shoving her into the car. This started the lady herself, who at best knew but few German words. A rush was made by both mistress and maid for the luggage which still lay at the door of the car. The first whistle sounded. The conductor endeavored to close the car door, seeing that the ladies were almost crazy. Having had enough amusement already, I took pity on the strangers, and told the conductor that these *few* traps belonged to them, and that they wished to take them in the car. He look-

ed very much puzzled, and asked me whether they belonged to an opera troupe traveling to some interior town. Time was scarce. He looked into the car, calculating how many seats the luggage would occupy. Finding that, even if one half the car was vacated, there would be scarcely room enough, he put the two ladies into the car, and, with the help of two of his companions, who came to see what was the matter, gathered up the packages and bundles, and threw them into the post-wagon. The whistle sounded, and away we went.

I knew from my travels in old times that Russian ladies were fast talkers, but I never had the least idea of the rapidity exhibited by these two; and I believe that as Russia is improving rapidly in all its movements, these two ladies endeavored to imitate the speed of the telegraph. The mistress accused the maid of slowness in not taking in the bundles quick enough, saying, "Now all is lost, and never will be recovered again." The maid defended herself, saying how impossible it would have been to have taken them all in, adding, "I told you so, madam. How lucky it was that young master sent the greater portion of the baggage as freight, by steamer, up the Rhine!" This remark by the maid raised a smile on my countenance which I could not suppress. I told the lady not to be worried, that the baggage was all safe, that the conductor had put them in the post-car, and when they stopped all would be delivered to them. This information seemed to relieve them.

I wanted to ask her how many years she had spent in this part of Germany. This question the reader would justify if he had seen the number of boxes and packages, the fourteen tickets for trunks, and had heard the remark of the maid that her young master had sent the bulk of the baggage as freight. The lady kindly informed me that she came for her health to the several watering-places, and had been here for two months, and was now returning home. I congratulated her on her speedy recovery of health, as she looked a picture of good health. But she differed very much with me in that respect, stating that she was very delicate, and continued so much so that she even refused to go with her brother to Paris, though she *did* need dresses very much. She was a *widow*.

Thanking me for my aid in making the conductor understand their embarrassment, she asked me what part of Germany I was from. My answer that I was a Californian seemed to astonish

her. Every body in the car looked at me, and I became the lion of the time. My fair neighbor asked me many questions about the gold; how long I had lived in California, and so on. I told her eleven years. "Why," she said, "and you have not been killed! How have you escaped so many years without having been murdered? But," she added, "may be you had a strong guard around you." I told her that, living in the country, far from any neighbors, my doors were never locked night or day. She heard all this with great surprise, asking how it was that newspapers gave so many accounts of murders in America, particularly in California. The gentlemen passengers sitting in the cars, with inquiring looks, evidently desiring to hear my reply to this question, I explained to her that whenever a murder is committed the local paper will chronicle it, and neighboring papers in the towns and cities repeat it, so that it appears to the foreigner that each announcement refers to a different murder. I remarked, too, that we had no more murders than other nations, but that with us every murder, suicide, or railroad accident is published far and wide, whereas in European countries no such thing is done. I asked her whether in St. Petersburg, Moscow, etc., the dead houses are ever empty? whether it is not often the case that ten or fifteen persons are lying in these places, stretched out by the hand of murder or suicide? whether this is not the case even in the best governed, politest city in the world—Paris, never a day passing that dozens are not found in the Seine? But who hears of these casualties? Nobody save he who is in search of one lost, or some stranger who goes to see them, led by curiosity. This seemed to satisfy the lady as well as the rest of the company.

But now to the gentlemen of the press of this State a few lines, which I hope they will take kindly. It is concerning the practice of copying accounts of murders, suicides, and robberies from other papers; of re-echoing, multiplying, and, in fact, spreading the facts as far and wide as possible, so doing great injury and injustice to our young State. Some of our papers are not satisfied with such occurrences in our own State, but they will take these accounts from the papers of Oregon, Washington Territory, and Washoe. These places are not known in Europe, but California is well known; consequently, these publications are at the expense of our State alone. This is even the case in the Eastern States. For instance, a San Francisco paper states: "We extract from the *Portland Courier*" (or whatever the name may be) such

and such an account of a murder. The reader in Europe or in the Eastern States does not know where Portland is; he has read it in a San Francisco paper, and therefore thinks it in California. But the zeal and energy of newspaper men does not end here. Some will carefully register all crimes committed, and publish them quarterly, half yearly, or annually. Others go still farther. The divorce cases, lawsuits, names of bankrupts, are summed up and published half yearly or yearly. If this collection of our vices, so carefully collected, which we send broadcast to the world, is intended to scare off emigration, no better method could be invented. It is certain that the press does not desire this, but publishes without considering what effect it may have on the other side of the world. I suppose the intention is to chastise, mortify, and expose these crimes to our own people. This would be very well if other countries did the same to their own people; but, as Napoleon said, when a row was kicked up about an illegitimate child in the family of a noble and the case was brought before him, "The husband of the wife must be the father of the wife's children before the world. Dirty linen must be washed in the family." If, then, other nations wash their dirty linen in secret, and we do it openly, other nations will have considerable advantage over us in the eyes of the world. This was by no means the only time while traveling in Europe that I heard mentioned the immense number of crimes which occur in California. In fact, it is only known for its gold and its crimes.

Why do not the papers chronicle with the same minuteness accounts of our material and commercial progress. Give the statistics of our agriculture and manufactures. They would then astonish the civilized world with the unparalleled wealth, prosperity, industry, and energy of our really wonderful people. If the press will bestow the same labor in statistical reports as they do in reporting crimes, I warrant that, in a short time, California and its great and various wealth will be truly known all over Europe; and as no country on the face of the globe can really offer the same advantages in so many and various ways to men of industry and of wealth, soon a population will flow in, from all parts, of all professions and occupations, filling our cities, tilling our valleys, mountains, and plains. Who has read "Robinson Crusoe," and has not desired to travel and see the world? Where is the man who has read descriptions of London, Paris, or Rome, and does not desire to visit them? But how can a man desire to em-

igrate to a country from which he has heard nothing but tales of crime, of which he knows only the bad side? But I will leave this topic and return to my journey.

August 28.—At one o'clock we left Mayence for Heidelberg. Immediately upon leaving Mayence we saw some vineyards upon very steep hills. The ground was walled up. After proceeding along for some miles, we entered a large, wide plain. It is very well cultivated, and divided into very small lots, well planted with fruit-trees. The grain is all harvested, but the stubble shows barley, oats, and wheat. There are yet potatoes, hemp, and occasionally a patch of tobacco. The closer we approached Manheim the thicker grew the tobacco-plots. After leaving the ancient city of Manheim, the ground was principally planted with tobacco, which is small, not being higher than about eighteen inches to two feet. I saw but two qualities, the long-leaved or Hungarian tobacco, and the round-leaved, or what we call the Kentucky seedling. Judging from the size of the plant, I hardly think that more than 600 pounds can be raised here to the acre.

At four o'clock P.M. we arrived at Heidelberg. I hear there is a nursery in the vicinity; and as it is the first one I have found since I left America, I will reserve this treat for my birthday.

August 29.—This day was spent in arranging my correspondence and bringing up my journal. This evening we took a walk to see the celebrated Heidelberg ruins, which are still in a tolerable state of preservation; but, as it was no part of my mission to examine and describe old ruins, I pass them by.

August 30.—Having traveled almost all over Germany, and considerably out of my way, to find a nursery, I am at last to be gratified. At three o'clock we started for Wiesloch. Upon arriving there, we immediately went to Mr. Carl Brunner, the person recommended to us by Director Thomä. We found him at home. Upon telling him my errand, he immediately took me to his nurseries and vineyards, located at some distance from town. The nurseries are in small strips; for here, as almost all over Germany, every man has his land in several places and in small strips. For instance, Mr. Brunner has over sixty *morgens*, and in about eighty different pieces. This is very troublesome business, and has but one advantage—that when a hail-storm comes, as it is only in streaks, it does not take the whole of any one man's land. We examined many of his nurseries and a part of his vineyards. His catalogue contains over 400 varieties of

grape-vines, but I selected only such as are raised in this neighborhood, amounting to 100 varieties, according to the catalogue. The vineyards showed but a poor crop, or, in fact, no crop at all; as the frost so killed the vines in the spring that a *morgen* with 4600 vines will not give fifty gallons of wine. But still these people do well; for when there is a good year, it pays them well for all their trouble and expense during the bad ones.

After visiting the vineyards, we went to see the venerable Mr. Brunner, who has written a valuable book upon the grape and the making of red wine. For fifty years he has been engaged in collecting the most celebrated varieties of vines from all countries, but in later years he has given his nursery and collection up to his son and retired, only retaining the business of buying and selling wine.

The old gentleman is a learned man, and well merits the esteem he possesses of the larger part of Germany. He is a great amateur of roses and flowers in general, and he has a garden of considerable size, where he has collected over one thousand varieties of roses. In this favorite place of his we found the old man. He is lively, pleasant, cheerful, and content. He showed us his garden, and opposite it a vineyard which is thirty years old, and has several varieties of vines planted, but each in a separate lot. Here, as elsewhere, the frost has destroyed this year's crop. The vines are raised on a trellis, not tied to stakes; but small sticks are driven down about five or six feet apart; then other sticks, mostly split from poplar, are tied to the upright stakes. This makes a kind of trellis. In some parts, where wood is more distant, and consequently costlier, the cross-pieces, instead of being wood, are wire; and it is to this that the grape-vines are tied. This trellis-work is about three to three and a half feet high. The opinion in respect to this mode is divided. Those districts which raise their vines on sticks contend that their method is the best. Those that have trellises are in favor of their own mode. One thing is clear to me—that the vines raised on straight sticks are easiest to work; for when you are in a row of trellised vines, you are obliged to go to the end before you can enter another row; besides, the shade on the trellis must be more than on the other.

August 31.—The vineyard of the old gentleman is on a side hill, quite steep, but not so much so as to prevent a person climbing it without steps. The soil is red, containing much gravel—is volcanic. Clay is its general characteristic. There is a great

deal of red wine made here, but more white. The wines have a good reputation, but are not classed as "Number One."

The fermentation of the white wine is the same as already described. The vineyards being small, and belonging to poor people, the selecting of grapes is very little practiced; and this is the reason why no such fine wine is here made as in Hochheim, Steinberg, Johannisberg, etc. Still, even here the people pick out the rotten grapes, leaves, and unripened bunches, as they would greatly injure the wine.

Mr. Brunner also showed me his wine-press, upon which he prides himself, it being more compact and occupying less space than the usual presses. It is furnished with one large iron screw, which is turned at the top with two levers which reach to the outside of the press-box, so that the operator may walk around the box pushing or pulling the levers. The advantage lies not so much in the screw as in the mode of filling the press, which is done in the following manner: The box is filled about one foot, when the screw is turned hard down on the mass. When this is well pressed the screw is raised, and another foot is placed upon the first mass and also pressed. The wood pieces upon which the screw presses are then taken up, but the plank with holes bored through, which forms the top piece on the mass, is left, and on this is placed a tier of stems, seeds, and grapes, to a thickness of a foot; and upon this, again, a wood piece is placed on which the screw presses, and the operation is carried on as before. Thus every particle of juice is pressed out of the lower mass, which is then taken out, and the upper mass takes its place.

After examining every thing sufficiently, we started again for Heidelberg, where we arrived at 11 o'clock A.M. The whole day was occupied in continuing my correspondence. In the evening I went to see the great tun of Heidelberg—the largest in the world. I extract the description of it from the guide-book:

"This tun was built by the cooper John Jacob Engler the younger, in the year 1751. It is said to have cost the enormous sum of 80,000 florins, and was often filled with costly wine of the Palatinate. It is 32 feet long, 22 feet in diameter at the ends, and 23 in the centre. Its 127 staves are 9¾ inches thick, and its circular bung-hole from 3 to 4 inches in diameter; 18 wooden hoops, 8 inches thick and 15 inches broad—the different rafters of which are bound together with iron hoops and screws, but the hoops at the two extremities are 18 inches in breadth. Of the hoops that now remain there are only eight, and it is not known

at the present day how the rest have disappeared. From the front as well as the back ends of the tun, bent in toward the interior to meet the pressure of the liquid, it is each time held in toward the centre in its concave form by four strong rafters, the ends of which are fastened to the bottom and to the staves by iron hoops and screws. The tun reposes upon 8 very strong wooden supporters, beautifully carved, and raised several feet from the ground. The height of the whole work is, from the floor of the cellar to its highest point, 26 feet 5 inches; and on the top, in front, there is a shield surmounted with the electoral cap on an azure field, and the initials in gold of Charles Theodore. This mighty tun surpasses in size all its predecessors, for it can contain 236 fuders, or 283,000 large bottles of fluid in its colossal space. It has been three times filled with wine—in 1753, 1760, 1766. There are still to be seen in the cellar the compasses, plane, gouge, and timber mark which were used for its construction. The compasses are 8 feet 6 inches long—some verses are carved upon them; the plane is 7 feet long, 10¾ inches broad, and 4½ inches thick, with the name of the head workman carved upon it. On the top of this tun is constructed a flooring, 27 feet 7 inches above the floor of the cellar, where a numerous company may assemble to enjoy the pleasures of the dance. The vat is filled by a vertical opening in the top of the vault. There is a small iron pump over the cellar by which the tun may be emptied. In the cooperage there is another tun which holds 47 fuders. In its time of splendor this cellar is said to have contained 12 such barrels."

September 1.—We started from Heidelberg at ten o'clock for Basle. The road follows the foot of the mountains and the banks of the Rhine, which here flows into an extensive plain, which extends far beyond the reach of the eye. To the left of the railroad are high mountains rising up gradually. On their sides, about one third up, vineyards are planted all the way, which are healthy in color, and bear a good crop for this country. The mountain tops are covered with forests. Here the Schwarzwald begins. We passed many thriving villages. The plain is generally cultivated with tobacco, hemp, Indian corn, millet, hops, potatoes, and beans; but the largest portion is meadow, which is irrigated from time to time by flood-gates, which let in or keep off the water. Poplar-trees are planted around each lot in the meadow. Fields which are more elevated are planted with plums, prunes, apples, and walnuts. The latter predominates, and may be set down as one third of all the trees here planted.

The hemp, in all parts where it is planted, when ripe, is pulled out by the roots, spread upon level ground, and kept there for a

couple of months. Then it is crushed with a simple wooden machine, and thus divested of the woody substance, leaving only the hemp. Some good wine is raised here; but as no particular care is taken in its manufacture, it has attained no celebrity.

Upon approaching Basle I noticed the old-fashioned way of manuring the ground by burning it. The mode is simple, and not costly where wood is cheap. The land is first plowed deeply in furrows about twenty feet apart; a small pile of wood is made of limbs, roots, etc., which is then covered with dust, and lighted like charcoal, and is kept burning slowly, now and then air-holes being made to prevent the fires going out. The people here are so expert that they do not lose the wood, but make it into charcoal; so they not only manure their land well, but also have the additional gain of a quantity of charcoal. At six o'clock P.M. we arrived in Basle—a picturesque old town, situated upon the banks of the Rhine.

September 2.—At nine o'clock we started with the cars for Geneva. The railroad runs in a narrow valley about one mile wide. The hill-sides are cultivated as grain farms, and there is only now and then a vineyard. In the valleys are meadows, irrigated by flood-gates as above described. The farm-houses are large, and built of stone; many of them are situated almost at the top of the mountain. Prunes, apples, walnuts, wheat, barley, oats, and rye are raised; also potatoes, beans, hemp, and some Indian corn. The mountain sides are well cultivated, and often large stone houses can be seen on the summit of the mountains. At Beel we changed cars, and seemingly country too, for from here the vine seemed to be the exclusive cultivation. Every foot of ground, even three fourths up the mountains, is planted with vines, which are looking well, and have a good crop. The soil is yellow clay, much intermixed with rocks and gravel. In many places rock walls are built up to hold the soil. Where the vines are growing, much labor is bestowed upon redeeming land enough to hold fifty to one hundred vines, planted three and a half feet apart, and the rows two and a half feet. In California such a piece of ground would hold only seven or nine vines (as we plant them), and would cost about $400 to make it.

We soon came to the end of the lake, where lies Neufchatel. This lake, with its mirror-like smoothness, its limpid waters, and surrounding scenery, can not fail to draw the admiration of the traveler. Still, however grand its beauty may be, it can not

equal the wild grandeur of the lakes of Wisconsin or Minnesota before the hand of civilization robbed them of half their beauty. Those thousand lakes, lying calm, peaceful, under a cloudless sky; that solemn stillness; the deep dark foliage of a thousand different tints and shades in autumn—all this, when once seen, can never be forgotten, and the lakes of Switzerland lose half their beauty by the comparison.

At the village of Neufchatel we changed cars for Geneva. Near this place the soil is reddish, and its wine has some renown. The cultivation of the vine is carried on with great industry, but the soil is poor, and requires a great deal of manure. The vineyards lie three fourths up of the side of the mountains; beyond them are the fruit-trees, and near the top are either bare rocks or dense forests. We arrived in Geneva after traveling eight hours continually among vineyards from one mile to three and a half wide. Not a spot as large as an ordinary brick-yard was left uncultivated, with the exception of where the old vines have been cut out to give the ground the necessary three years' rest.

Upon our arrival at this ancient town, celebrated for its watches, we were obliged to drive around some time before we could obtain lodgings, as at present there is a convention here of ministers of all Protestant denominations. At last, however, we found rooms and a good supper, to which we did ample justice.

September 3.—Having taken a carriage, we drove around the city and along the shore of the lake which lies at its side, on the mirror-like surface of which floated dozens of swans. The bridge across the river at the lower end of the lake is a great work of art. The neighborhood of the city is picturesque; the bold, towering rocks, always capped with everlasting snow, inspire the traveler on a September day to wish himself in one of those crevices, where he might breathe an atmosphere rather lower in temperature than 85°. After seeing all the sights, we drove to the hotel, discharged the driver, and started to have our revolvers cleaned up and reloaded, as we had to cross the Alps. From thence we went to the United States Consul to have our passports viséd; not that it was required, but to avoid the annoyance of running to the Consulate, perhaps not finding the Consul in, and, above all, paying your tribute of one dollar for his signature.

Coming from the Consul we met Mr. Samuel Brannan and his lady. Mrs. Brannan, with her children, live here, in a very fine villa, surrounded by extensive grounds, adjoining the town; a

more desirable residence could hardly be wished. Mr. and Mrs. Brannan kindly invited me to remain some time at their villa; but this offer I was obliged to decline, as my duty called me to work in other parts. Mr. Brannan visited me at the hotel, and we together went to visit Mrs. Hitchcock. On arriving at her residence we found that Mrs. H. was absent, but were received by Miss Hitchcock. With this young lady's graceful reception and accomplished manners we were very much struck. But time prevented us from enjoying long the pleasure of her company, as we were obliged to make haste to take the cars, which conveyed us to St. Jean de Moreno.

The road runs a long time on the banks of the River Rhone, and at the foot of a range of hills, which are planted thickly with vines. I noticed that some of them were planted four feet apart, and without sticks, as mine are in Sonoma. The vines were not pruned, and were well filled with grapes for this country. Occasionally I saw some staked vineyards, as if opinions differed as to the best mode; but the unstaked were the most prevalent.

On reaching the French line we were stopped, and got out to have our trunks and passports examined; but as I passed the official without even giving him a look, he allowed me to go on without a question. The trunks of my party were merely brought in and taken out without the slightest investigation. This being the limit of the Sardinian territory lately annexed by Napoleon to France, we soon saw something of the Italian mode of cultivating the vine, which is planted by a small tree, and allowed to run entirely over it, making it resemble a diminutive haystack. The rows are about 100 to 120 feet apart. In this space is planted grain or Indian corn, of which much is here raised. On the lake side vines are extensively raised in the manner before described. Mulberry-trees also begin to make their appearance, sometimes with grapes running over them, and sometimes furnishing food for the silk-worm.

Night soon set in, and nothing could be seen but a few lights dancing about on the towering mountains at whose base we passed. At half past eight o'clock we arrived at St. Jean, which is the terminus of the present railroad. The hotel at which we stopped was only a few minutes' walk from the station, but the town itself is a quarter of an hour's walk.

September 4.—Early this morning I went to hire a carriage to take us across the Alps. I succeeded, and we started at seven

o'clock, keeping along the banks of the rapid stream. The scenery is thoroughly grand: high mountains covered with the stately pine; huge rocks towering above us, as if on the eve of falling to crush the intruders; thousands of waterfalls, which resembled from a distance a silver ribbon; in the far-off distance, mountains clad with perpetual snow. There are many coal-mines on the road, and villages which seem above the clouds. The land from one rod up to five rods is all worked, but without oxen, mule, or horse, as the inhabitants work their small property with spades. Only a few vines may be seen now and then.

September 5.—The tunnel which is now being constructed will, when finished, connect Italy and France, and will be four and a half leagues in length. They are now pumping air into it, as the workmen suffer much from its want. We passed within half a mile of it, but as it was not connected with my commission I did not visit it. After riding four miles more we stopped at a small village and took our dinner. The mountains begin to show more and more snow; still, right under these snow-banks may be seen houses, and herds of cattle grazing. Terrace upon terrace is built from five to eighteen feet, according to the steepness of the hills. This flat of ground is gained by walling up the side of the mountain, and then carefully filling the space with sifted ground gravel, and the manure which the poor peasant treasures up with great care during the whole year. The crops raised on these patches of land are brought down on the backs of men and women.

On this road is the Fort St. Albert; the old one was blown up by Napoleon. The mountains began to become more and more distinct with their masses of snow. The cascades were more and more numerous. At last we arrived in the village, where we were to remain all night. Next morning, on the arrival of the stage, I found that the poor travelers were almost frozen with cold, which was intense during the night in the valleys and deep ravines of the snow-clad mountains.

At seven o'clock we started. Four mules were placed to the carriage, as here the road begins to rise from the plain to the mountain. The road winds so gradually around the mountain, and is in such excellent order, that one hardly feels the gradual rise. It was constructed by Napoleon, and the French side is kept by that government; the Italian by Victor Emanuel. At a distance of every half mile there are men who water the road from morning till night from a small ditch which runs alongside,

and which is supplied with water by the thousands of natural falls. The man on the road is furnished with a huge wooden shovel resembling a ladle; with this he throws the water over the entire way.

When about one fourth up the mountain I got out of the carriage, and walked across the summit of the Alps, arriving on the opposite side at a tavern about ten minutes sooner than the carriage. Near this tavern is a small lake, on the border of which Napoleon had some breast-works built. There is also the old hospital which he erected for his wounded soldiers.

We soon continued our journey at a slow trot, never fatiguing the horses. The reader may judge how gradual is the descent when I say the small ditch at the side of the road runs steadily at a rate of four miles an hour. At two o'clock we arrived at Susa. At the gate a custom-house officer mounted on the carriage, and took us to the railroad station, where is also the custom-house. The officers politely passed our trunks without opening them, and informed us that we could leave them there with perfect security. Therefore we went to a hotel, took an excellent dinner, and, at five o'clock, started for Turin, where we arrived at seven.

After taking rooms we went out for a stroll, passing the King's palace, where there were several carriages in waiting. The salons were all finely lighted up, and, as the windows were open, we were enabled to see some large oil paintings. However, as we were very tired, we soon returned to our rooms, and sought our beds.

CHAPTER VI.

ITALY:—WINE AND SILK.

Turin.—Passports.—Leave for Genoa.—Vines and Mulberries.—Plowing.—Grain Crops.—Manuring.—Asti and its Wines.—Reach Genoa.—The Birthplace of Columbus.—Narrow Streets.—Professor Isnard.—Procure Vines.—Nova.—The Silk Manufactory.—Jealousy of Visitors.—Scanty Information.—Raising Silk-worms.—Return.—Effects of Asti Wine.—Return to Genoa.—Wine-making in Italy.—No Berths for Civita Vecchia.—Leave for Marseilles.—The Voyage.—Laying by.—Extra Charge for Board.—Arrival at Marseilles.

September 6.—Finding that nothing in the way of wine or silk raising can be done in Turin, I started this day for Genoa, through the town of Asti, where the best wine of modern Italy is said to be made. Before leaving Turin I thought it would be better to have my passport viséd by the Pope's embassador, therefore I sent it to that officer, but was surprised to hear that I must first go to the American minister, as he had officially requested him and all other ministers not to visé any American passports unless first seen and viséd by himself. I then sent the servant to the American minister, who requested me to call upon him. This annoyed me considerably; but still, as it had to be done, and as I intended to call upon the minister anyhow, I went, and was received kindly. He apologized for putting me to so much trouble, but such were his instructions with regard to all. He signed our passports without charge; and, thanking him, we bowed ourselves out, and went to the Pope's embassador, who made no farther trouble.

Turin is the present residence of Victor Emanuel. It is a handsome city, the houses being built in modern style, the streets wide and clean. Some fine public squares adorn the city, also some fine fountains; but, above all, it is very conveniently built for a hot climate. Its side-walks are almost all arched over, so that one may go almost all over the city without being exposed to the sun or rain.

At three o'clock we left Turin. Here the country is rolling hills, more yellow clay than sand. On these hills are planted

grape-vines; in the valley, fields; and the fields are surrounded by mulberry-trees, of which, each year, the growth of the last is trimmed off, so that there shall be new and more tender leaves for the food of the silk-worm. As the tree is low, the leaves do not spread, and are easily gathered. The production of silk here is very extensive and profitable. When I reach Genoa I shall examine this subject thoroughly.

The vines on the hills are planted in two different ways—some by trees, and allowed to run over them; the others by trellis-work. Both seem to do well; the vines hang full of grapes.

The plowing in the plains is done with the limb of a tree shod with iron, and drawn by a yoke of oxen. It is wonderful how with this ancient Roman plow they can strike such beautiful furrows. They are now summer-fallowing for putting in wheat, and they do it beautifully. But it is very difficult, and but little can be plowed in the day.

The wheat, which they thresh with flails, is all the bearded red kind, known in California as the "Mediterranean wheat." It is a sure crop, and never mildews or rots. Much Indian corn is raised here; it is the deep-yellow corn, almost red. Millet for consumption is also raised in large quantities. Now and then a small patch of sugar-cane can be seen, but I suppose that is more for fancy than profit. Will my readers believe that these people are so far back in improvements that they have no fanning-mill, but, as in olden times, clean their grain by throwing it against the wind, and then sweeping it together, so that the husks not taken off by the wind are swept off by the broom?

I also observed that they plant poplar-trees in the meadow around the small lots, so that the falling leaves shall manure the ground. I likewise noticed that burned earth was brought from some other part of the property, and laid upon the ground for amelioration. It is said to increase the crop by one half.

The town of Asti, from which the wine of that name comes, is situated in a rolling country, the hills being small, none being higher than Telegraph Hill of San Francisco. The soil is yellow clay, with no gravel. It is about one third sand. The wine here raised is by no means considered generous, but it is cheap and pleasant, as it has not the bitter taste of the French or Hungarian wines. It is light, and excellent to drink in a hot climate. I emptied a bottle with good will, and almost at one draught. The wine had no intoxicating effect upon me. It is principally red

wine. The white is not so good, being more sweet and stronger. Champagne is also made from these grapes.

Leaving Asti, the land continues to be undulating, and the vineyards are the same until Solero. Gelezzano has the same wine as Asti in the plains, but mulberry-trees and grain are the chief produce; still, the vines never fail, and abundantly remunerate the planter. Not the slightest attention is paid to the selection of grapes or their fermentation. I understand, however, that there is a gentleman who has attended to wine-making, and that he was successful in making a generous wine. I will return to Asti, discover his whereabouts, and get as much information as possible, for the Asti vines will improve on our red soil.

After leaving Solero we entered a large plain, extending as far as the eye can reach. This plain is all planted with mulberry-trees. We passed the strong Fort Alexandria and several small villages; but darkness soon set in, and I could see nothing of the country. We also passed through several tunnels, some of them four or five miles long, judging from the time it took us to pass through.

At half past nine in the evening we arrived in Genoa, and were taken to the ancient building now occupied by the Hotel Feder. The apartments are truly fine, from thirty to thirty-five feet square, and finely arched, the ceiling being twenty feet high in the centre. It is also frescoed, and the walls are painted in the same. The cornices are finely gilded, and the rooms contain massive ancient furniture.

September 7.—After writing my journal I began to make inquiries as to where I could see silk manufactories and where contract for vines. The accommodating host promised to furnish me to-morrow with all the necessary introductions, so there was nothing left to do but to roam through this old city, the birthplace of Columbus.

It has a fine inclosed harbor, where lie hundreds of small craft trading on the coast. The wharves are scenes of busy confusion. Men half naked are here employed from morning till night in loading and unloading vessels, and drawing heavy weights on a car on low wheels. They do immense labor; still, their earnings are very small.

From the quay I turned my steps to the interior of the city, which I found beyond description—the streets about six to eight feet wide, very irregular; the houses on each side five and six

stories high, dark and dirty-looking, and from the windows of the houses the neighbors may reach over and shake hands. A person may imagine that such a street has not the sweetest odor in the world. No wagons can go in the streets, nor are there many used, as men do the work of horses and mules. Still, there are a few of the latter seen sometimes. When they are loaded with a bulky substance, a person meeting one finds himself in a very precarious situation in the narrow streets; and if there is not a doorway or a cross-street near by, it is a question whether he or the donkey will remain master of the field. The shops in these streets are dark, and the mechanics work almost continually by the light of a lamp. There are a few openings in this city, which can not be called squares, but only spaces of 100 feet, in the most irregular form possible. I found several *no-shaped* places, where they sell vegetables and fruit. These were fresh, and excellent. The almonds, oranges, and lemons look very fine; the white fig is delicious.

September 8.—I took a carriage and started out with Professor R. I. Isnard to a neighboring village, and, after examining the vines and fruit-trees in the nursery, I engaged a person at Rivara to pack and send to me at Marseilles the following varieties of vines: *Bosco*, *Melea*, *Bianchetto*, *Vermentino*, *Bois*, *Nebiolo*, *Bianco de Asti*, *Malvoisea*. The above vines are all native to this section of Italy. The grapes are excellent. I engaged cuttings as well as rooted vines. After this we started for home, which we reached after a very dusty ride. When it came to paying the hackman, he asked double the price of what I had agreed to pay; but as I had no time to argue, I gave what he asked and left him. I made an arrangement with Professor Isnard to start to-morrow morning at five o'clock to the small town of Nova to see some silk manufactories.

September 9.—We reached Nova at eight o'clock, when we took breakfast, and immediately started for one of the principal silk manufactories. After much difficulty we were at last admitted, as the overseer thought me French, of whom they are very jealous, for fear they will learn something of their silk manufactory. With great mystery and suspicion they showed me the cocoons, which they had in a lofty magazine. They were spread upon cane mats, placed one above the other, upon racks made for that purpose. From this place I could look down to where the women, about 120 in number, were at work unwinding the cocoons.

These are placed in warm water, and the end of the thread being found, it is wound upon a wheel driven by a steam-engine. Each woman has a wheel and an iron box before her; in the latter are placed the cocoons.

The overseer took great care that I should not see much from my stand; he urged me into the next room. I soon bid him good-by, telling him that I did not care much to see his machinery, as I had used the same thirty years ago, with the exception of the steam-engine; and in regard to that I told him that at any time America can send him machinery so complete that he would not need the women. The man looked astonished; but, as I was offended by his making so much mystery about nothing, I left him. We went to another man; but here also we met with the same difficulty. He was willing to show us all the cocoons, but nothing else. To my inquiries as to how many hands are required for 100 trees from six to ten years old, or how much silk is made from 100 pounds of leaves, the man gave me such unsatisfactory answers as showed that he either wished to mislead me, or he did not know any thing about it; consequently, I started off in search of some plain farmer who would give me the desired information.

At last we found a place where there were three hundred trees, which were thirty years old, according to the statement of an old lady, her son, and daughter, who all answered me at once. Imagine me in an Italian peasant's house, surrounded by the four inhabitants and many others, who were wondering what the strangers wanted; why they examined the mulberry-trees so closely, and so forth; and you will understand that it required a little patience to wait for the answers of these people. I asked the old lady how many pounds of cocoons she makes from the trees; at what price she sells the same; how many ounces of eggs and seeds she uses; how much labor, etc. The whole family at once kindly answered all questions but the two last, which seemed to strike them with astonishment. The idea that they should know how much labor is necessary, or how many leaves are used to an ounce of eggs, seemed something preposterous.

I was obliged to have recourse to the most roundabout ways in the world to ascertain that in some years they get 1000 francs, in others 2000, and sometimes as many as 4000 francs from the 300 trees. The labor takes about four to five weeks, when it is all finished. The family do it all themselves, and even the four

are not kept busy the whole day. When the leaves begin to grow in spring, and when they have attained their full size, they put a certain quantity of eggs under the mattress upon which they sleep: the bodily heat hatches the eggs. Then some leaves are cut up very fine and put in a dish. Several whole leaves are then put above the young worms, who creep upon them. They are then laid in the dish, and begin to eat. As they grow, the leaves are cut up less fine, and the worms are placed in larger dishes, until they are placed on cane mats suspended from the ceiling. They must be regularly fed, and a great deal.

Rain-storms, or much lightning, will sometimes kill a whole brood. When the worms are ready to wind themselves, some dry weeds are stuck in the mats; the mature worm ascends and spins himself in. This is all the information I gathered from these people, who kindly and willingly told me all they could. Still, I should never have been able to understand them if I had not known the whole operation before; for I raised silk-worms on a large scale, and in the most approved manner, on my domain in Hungary. But I was willing to give my readers the manner in which these people raise the worm. I will give a more detailed description, as I intend to investigate the matter fully in the silk-growing districts in the south of France. After presenting the lady with a five-franc piece, I took my leave of her, but not before showing her a piece of quartz, and telling her that gold was found in such stones in California. Her astonishment it would be impossible to describe.

I hurried to the dépôt in order to be in time for the steamer in Genoa, which was to arrive from Marseilles, and go to Civita Vecckia. I would here stop with my journal, and only continue it from Genoa, but I must make a statement, which, though personal, gave me a piece of information concerning the wines made here.

As I before stated, upon our arrival at Nova we had taken breakfast and a bottle of wine, which was Asti white wine. We between us emptied about half the bottle, as it was very sweet, sparkling like Champagne. It had a fine bouquet, but was made without care or system.

Soon after starting with the train I felt a terrible pain coming upon me. I suffered intensely. I could not imagine from what it originated. I had eaten no fruit, caught no cold, and my breakfast was cold chicken and potatoes. My sufferings were intense;

at last I fainted when the train stopped. After I had recovered a little, the Consul General of Holland, who was in the train, and who kindly assisted me in my agony, asked me what I had eaten. As soon as I told him I had taken some Asti, he said that was the cause of my illness, and that it had the same effect upon all strangers, as it is badly fermented, and frequently the peasants put honey in to make it sweet. Therefore I warn all my readers never to drink Asti wine, and then journey in the cars.

Much weakened and fatigued, I arrived in Genoa, when, to my annoyance and sorrow, I found that the steamer for Civita Vecchia had not another berth, and that even the next steamer, which will start only in five days, is not certain to be able to accommodate us with berths. The season advances rapidly; the grapes will be picked in a few days in the south of France and in Spain; therefore I have resolved to leave Rome and Naples unvisited, as I can, through friends, order the cuttings and trees. This is all I can do for my readers and those who have engaged vines; for as to making wine as these people, God forbid! They are as far back in this art as are the Mission Indians in California. I have resolved to embark with the first steamer for Marseilles, and from there go on to Spain and Portugal, where I will be in season to see the curing of the raisins, which is very essential knowledge for California, as this will form a large profit to it.

September 10.—I went to engage my passage for Marseilles, and here again I met with difficulty about my passport; for, notwithstanding that it was viséd by the minister at Turin, it was necessary to have it viséd by the Consul at Genoa. I was obliged to submit, and took my passport to the Consul, Mr. Paterson, who received us cordially, and viséd it without charge. He is expecting his successor daily.

Before I leave Genoa I will add that this was the ancient seat of the pirates, who lived here in perfect security, accumulating immense wealth. To quiet their conscience, they put much of it in churches and church ornaments. There are a great many churches here, built of the most beautiful marble, having richly frescoed walls, and gold and silver vessels innumerable. Traces of magnificent palaces still exist. This place suffers much on account of our troubles. The people seem content with their present ruler, Victor Emanuel.

September 11.—At six o'clock this evening we embarked for Marseilles. During the night some wind arose, and when I went

upon deck I found we were heading in for land. I inquired the reason of this movement, and whether we were to land at some port. The captain replied no. But as the wind continued to blow fresh, he ran the boat under shelter, and dropped anchor. The sky was clear, the day fine, but I thought that he might know certain signs which indicate a storm on this sea. We had anchored at the small village where Napoleon made his landing after escaping from Elba.

We lay there from eight o'clock A.M. till eight o'clock P.M. The wind was moderate, the weather clear; all the passengers, as well as myself, wondered why the captain did not raise anchor, when we had seen several large vessels pass us with sails full set. Still, I did not feel vexed, as my previous rapidity in traveling left me but little time to read my books upon wine, silk, etc., which I must finish, so as to be posted when I reach those countries where they are produced. I was quite at ease, as I thought that the captain had to board us until we land. In the evening the wind died away, and we started.

There were more than eighty steerage passengers, men, women, and children, all huddled together like so many swine. As these people had with them provisions only for twenty-four hours (in which time the steamer should make the trip), the poor children suffered a great deal.

September 12.—We arrived at half past twelve o'clock, but before we left the steamer the steward brought me a bill of twenty francs, and so to the other passengers, stating that the company gives us but two meals, a breakfast and dinner, and we had had one meal more. We objected, stating that we had asked when we paid sixty-two and a half francs apiece for our tickets, whether the board was included, and the officers replied that it was. Consequently, the company was obliged to board us; besides, there was no earthly reason for lying by, as the wind was not more than required for a sail-boat. Our arguments were vain, and, to avoid farther parley, we paid what was charged.

We did not disembark at a wharf, but were obliged to go ashore in a yawl. After waiting a long time in the custom-house for our baggage, it at last arrived. The officers politely passed it without opening the trunks.

Marseilles is a large, busy sea-port town. There are innumerable large, fine iron steamers in the inclosed harbor.

CHAPTER VII.

THE BORDEAUX WINE DISTRICT.

Leave Marseilles for Bordeaux.—Agricultural Notes.—Vines, Olives, Almonds, and Mulberries.—Montpellier.—Frontignan.—Cette.—Manufacture of spurious Wines.—Carcassonne.—New Vineyards.—Wheat and Maize.—Toulouse.—The Canal du Midi.—Montauban.—Prunes.—Agen.—Reach Bordeaux.—Botanic Gardens.—American Ships.—Steel-plated Vessels.—M. de Luze.—His Wine-vaults.—Price of Wines.—Corks and Capsules.—Barrels.—The Fruit Nursery.—A Bird Fancier.—Prune Establishment of A. Dufour and Company.—Drying and packing Prunes.—California as a Fruit Country.—Dinner with M. de Luze.—Visit to Chateau Margaux.—The famous Vineyard.—The Store-room.—The Press-room.—Manufacturing the Wine.—Chateau Rauzan.—A bad Year.—*Victor Rendu on the Wines of Bordeaux:* The different Sorts.—Wines of the Medoc.—The Vines.—Mode of Cultivation.—The Manufacture of Wines.—Quantity produced.—Classification of Medoc Wines.—The chief Vineyards.—Prices of Wines.—Prices of Vineyards.—The Champagne District.—The Vineyards.—The Grapes.—Cultivation of the Vines.—The Vintage.—Manufacture of Champagnes.—Classification of Champagnes.—Quantity of Champagnes produced.—Markets.—Departure for Spain.

September 13.—At eight o'clock we started on our way to Bordeaux from Marseilles. From this city to Rognac the country is planted with olive-trees, vines, and almonds. The olive is predominant, and is of a dwarfish kind. The almond-trees are trimmed as dwarfs. Some part of the country is rocky. The vines are planted in two rows, about two feet apart, and these are separated from the next two by a space of about ten feet. From this place to St. Chamas the country was poor and rocky in the extreme, but, wherever there was a place to plant, were found almond, olive, and mulberry trees. To Miramas the lands are planted with olives, mixed much with mulberries. Silk is here raised in large quantities. To Arles the country is a large plain, very rocky, and almost a desert. No trees, no grass can there be seen; all that meets the wearied eye is, from time to time, a sheep-house, but there are no sheep visible, as the scanty tufts of grass must be sought far and wide. The whole country has the aspect of an ancient river-bed. It is about twenty-five miles across. We afterward came to a region which was a little more fertile. It had

now and then some olive and more mulberry trees, but hay was the principal product. We saw some well-loaded fruit-trees, and in the distance some mountains which exclusively produce fruit, almonds, and vines. Till Secoloux there were more or less mulberry-trees and vines. There was some grain, but the soil was very inferior, being of a poor gray color. At Talasco we changed cars. The land and cultivation are the same as above until Mandeuil.

Nismes.—To the right the country was rolling, and planted with mulberry-trees. There were many young plantations. The olive-trees extend for miles and miles. We now and then passed some almond-trees. On the left side the country was more planted with grain. There were, however, many mulberry and olive trees in the same fields, either in rows or on the edges. After passing the Rhone vines are almost exclusively planted. Sometimes there are olive or mulberry trees having vines between them, but the practice is not general. I saw a plow, by which land was subsoiled, drawn by five mules, at the last place. Wherever the soil was red, vines were cultivated. The table-land this side of Talasco, as far as the eye can reach, is planted with vines, olive-trees, and mulberry-trees.

Milhaud.—Plantations of vines, with olive-trees between. The species of vine is the blue grape.

Uchaud.—On the right-hand side are rolling, rocky, low hills, planted with vines and olives. On the left is a plain. It is well elevated, and planted with olive and mulberry trees. The vintage has already here begun, and goes on speedily.

Vergere.—On either side, for miles and miles, there extends a plain, planted with vines, olives, and some mulberry trees.

Galargues.—The land is similar in aspect to that above.

Lunel.—This place is famous for its sweet wine, which is made in the same way, and is the rival of Frontignan wine. The soil, wherever vines are planted, is red. Its aspect is the same as above.

We arrived at Montpellier, where we stopped to see the surrounding country and the method of here making wine. Immediately on our arrival we set out to visit the olive-presses. We staid here over night, and started at eight o'clock for Bordeaux.

Villeneuve.—There were vines on each side of us, and all cultivated in the same way as mine in California. There were few olives and mulberries.

Vice-Merval.—The valley has been getting narrower. We passed through vines and some meadows which were well loaded.

Frontignan.—The vines are here much loaded. This is the place where the famous Frontignan wine is made. There are two varieties of grapes in the vicinity, the red Muscat and the white Muscat, of which the latter is the most in cultivation. The vineyards generally give ten per cent. on the value of the land. An acre is estimated at from fifteen to twenty thousand francs.

Cette.—Here we changed cars, the ones we were in going to Perpignan. The railroad runs through shoals of the sea from Frontignan to Cette. Every where that a foot of ground can be redeemed from them, it is done, and the spot is planted with vines; these, all along the sea-coast, were doing excellently. Cette is the great manufacturing place for spurious wines, millions of gallons of imitations being here made, of every brand in existence, and sold to all parts of the world, a few drops of the genuine being used to give the taste of the different qualities. So perfect are some of these imitations, that it is with difficulty you can distinguish the spurious wines from the genuine. The country around being flat and the soil sandy, the wine is very poor, and, as the vines yield largely, the wine is almost as cheap as water. The manufacturers buy up these wines, and, by their chemical preparations, fix them up, and sell them, mostly to the American market, for good prices. Such are the wines we drink as Chateau Margaux, Lafitte, Chambertin, etc., etc.

Adge.—The vines were planted still nearer the shore, and were looking well.

Narbonne.—Here we breakfasted. The whole country is one wide plain, and planted with vines. The soil is of a grayish color.

Capendu.—The country reaching up to this place varies from a plain to rolling ground, and has on all sides vineyards. Now and then may be seen some olive and almond trees raised in hedges.

Carcassonne.—Some of the land is planted with grain; the principal part of it is still planted with vines, however. There are hundreds of acres which have been turned into vineyards since the last twenty-five years. It seems to pay better than any thing else, as there is an extreme demand for common wines, which are used to correct other wines wanting color, strength, or body.

Rames.—The vineyards diminish and almost disappear. Wheat is the principal product. The plowing is done by oxen.

Castelaundrey.—The land is cultivated with grain, and appears pretty rich. There is a great quantity of Indian corn raised. It is *topped* to the corn-ears.

Villefranche de Lauregais.—The valley is exclusively composed of farming lands. The hills on either side are planted with vines.

Toulouse.—We here caught the first sight of the great Canal de Midi. It did quite a good business formerly; but, since the inauguration of the railroad, its importance has much diminished. The vine is predominant.

Orisalès.—The country is rolling; produces some wine and much corn.

Montlartier.—Vines on one side of the road, and grain, mixed with vines, on the other.

Montauban.—A large Protestant town, and famous in the history of the Huguenots. Vines are planted on each side of the road.

Castel-Sarrasin.—The vines are here planted in rows three feet apart, and these separated by a distance of forty to sixty feet, which is occupied by grain.

Marsac.—Vines are on either side of the track. The River Tarn flows along the valley.

Malouse.—The plum or prune cultivation begins to increase. On the hills, which are of moderate height, vines are planted. I saw many patches of cane, which is used for the drying of the plums.

Valence. — The country is cultivated with vines, grain, and fruit-trees.

St. Nicolas.—The cultivation is the same as above. The railroad runs for a length of time on the banks of the canal.

Agen.—A large place, famous for its dried plums, of which there are sometimes only thirty-six to a pound. After passing Agen night came on, and I could make no farther observations. We arrived at Bordeaux at twelve o'clock, well worn out with our day's journey.

September 15.—As it was Sunday, all that could be done was to walk around the city and write correspondence. Bordeaux is a very fine city. It possesses large shady walks, promenades, and squares. It has a good safe harbor in the River Garonne. Its botanic gardens, with their beautiful ponds, in which hundreds of gold-fish swim, and upon which swans extend their white and graceful forms, contribute in no small measure to the beauty of the city and the pleasure of the promenading community. Many ships from our own country sweep the harbor with their airy forms. High above all the others is unfurled to the winds

the beautiful *Star-spangled Banner.* In beholding the flag of my country, I felt rush into my heart a thrill of pleasure and pride. Even without the flag, it was easy to recognize at once our American ships. Their high masts, towering far above the forest around them, their sharp-cut bows, their finely-moulded lines, pronounced them American.

I saw building in the harbor two iron gun-boats. The steel plates were being put on; they were five inches thick. These boats are meant for the protection of the harbor; they are anchored at the entrance, and defend its passage. There were also building men-of-war. Several were completed; they were all steel-plated. The stone bridge across the Garonne is a very fine work of art. Bordeaux possesses several fine public buildings, of which the theatre is the principal. It is the finest and largest in France. What is most remarkable in it is the architectural beauty of the interior.

September 16.—The first thing I did this morning was to visit the house of Mr. Alfred de Luze—the largest wine-dealing establishment in Bordeaux, as it also is the most recommendable one. Monsieur de Luze is also consul of Frankfort and of the Grand-duchy of Hesse. The stately old gentleman received us with great cordiality, offering his services for any information or letters of introduction that we might need. Offered in the gracious manner that it was, and coming from such a source, I of course accepted it with pleasure, well knowing that it would be the means of making a thorough investigation in this vicinity.

Before leaving the office, M. Francis de Luze, son and partner in the house, kindly invited us to visit the vaults. Accordingly, myself and my son Arpad followed our polite conductor. We came to the cooper's shop, where a dozen or more men were at work repairing the barrels. Good wine is never put into new barrels. It is a universal custom in Bordeaux, in well-conducted houses, to use for first quality wine barrels which have already contained wine, which has taken out the astringent taste of the wood. These barrels, however, are taken completely apart and thoroughly cleansed, piece by piece. The barrels which we saw were intended for shipment.

Leaving the shop, we entered the vaults. Going from one to the other, we saw each filled with wine-casks four and five tiers high. Our steps led us through vault after vault, and each successive one became larger. Some of these vaults had six to eight

rows of barrels five to six tiers high. Rows, not against the walls, are composed of two barrels touching each other at one end, and having the other on a little alley which separates them from the next row. Mr. de Luze made us taste all the principal wines of the establishment. I need hardly say that they were delicious. Never had I before tasted such Bordeaux or Sauterne, though of each I had previously known excellent brands.

From this series of vaults we were taken through a series of smaller ones. They were narrow and long, being the place where the wine in bottles is kept. On each side the bottles are piled up to the roof, and each side is composed of one row four bottles deep. These vaults each contain several hundred thousand bottles, which have been here for many years awaiting their term of maturity. The contents of the cellars in bottles and barrels at the present time can not fall short of half a million of gallons. It took us two full hours to visit this grand establishment.

The custom of this house is only to buy in good years, and then largely. Last year being a bad one, no wine was bought except for the consumption of the laborers of the establishment.

The price of the wine depends upon the age and upon the year, coming from the same growth. The price of a barrel of sixty gallons is from 300 to 2000 francs, and sometimes even more. The bottled wines cost from three francs to eight francs apiece; but, of course, they are only sold at wholesale.

I am particular in describing this establishment, that my readers, who have flattered themselves that they have bought good Bordeaux in San Francisco at $40 and $50 a barrel, or at $4 to $5 a case, have been most egregiously deceived. Their Bordeaux was nothing more nor less than a miserable imitation. No good wine can be sold even here at any such price. Where, then, is the cost of transportation, insurance, interest, and duty, to say nothing of profits?

I may here mention the curious fact that this family has carried on the wine trade during four generations. This is very singular to us Americans, who change business so often in life, and sometimes in a year.

When we had seen every thing, and tasted all the noble wines, we took our leave, not, however, before receiving and accepting an invitation to dinner the next day, and a drive in the environs. After leaving Alfred de Luze's establishment, we visited several other manufactories of little importance; among these was one

which makes the capsules to place on the cork, and stamps them. The capsules, all stamped, cost twenty francs a thousand.

Making the necessary arrangements for to-morrow's work, we afterward went to dinner, then wrote, and then went to bed.

September 17.—At seven o'clock, according to appointment, Francis de Luze called with his carriage. We drove out several miles from Bordeaux, inspecting the vineyards, orchards, barrel manufactories, etc., etc. I was informed by M. de Luze that the barrels meant to contain fine Cognacs were made from Russian oak. The reason given for this is, that other wood gives an unpleasant taste to the brandy. New barrels made from Russian oak, holding sixty American gallons, having four iron hoops and the rest wooden, cost from twenty to twenty-two francs.

Leaving the cooper's shop, we drove to the largest nursery at Bordeaux, where M. de Luze left us. We examined this extensive establishment, and made our selections in fruit-trees from the fruit which we saw. We here found the very nicest and finest fruit that we had yet seen in France. After making and completing my contract with M. Catros-Gerand, I went home to complete my journal and write up my correspondence. On our way home we saw a bird-fancier who had some very fine pheasants, and a large variety of very rare birds. He asked sixty francs a pair for his pheasants, and ten francs for some fine pigeons. I was really sorry that I was not on my way home, else I would have bought the pheasants and other rare fowls.

In the afternoon we were taken by a nephew of M. de Luze to the establishment of A. Dufour & Co., whose business consists in packing and putting up dried prunes for exportation. We were politely shown round by the proprietor, and visited the whole establishment. It is situated in a large five-story house, each story having its special operation. The prunes, after having been bought from the producers, have again to be prepared by drying; for, to make them weigh more and appear larger, the producers do not dry them thoroughly. This operation is repeated only when the prunes are destined for distant lands and for long keeping. When they are not sent from France they may be put up as they are, after the selections have been made. The largest and best prunes are put into glass jars; the second best are put into paper boxes tastily prepared. Our guide showed us boxes thus prepared which were to be sent to Havana, the box itself costing twenty sous, while the prunes in it only cost eleven sous.

Thus the good people of Havana pay thirty-one sous for what they might have had for eleven. See where a taste for pretty things leads people. There is a still cheaper box which goes to the United States. The third sort goes in tin boxes, round or square. The fourth sort is put into barrels, and is meant for home consumption. Great system is employed in the whole matter. The house now employs eighty-five women and twelve men. Before the war in the United States broke out it employed two hundred and eighty women and thirty-five men. There are many other establishments in this vicinity which are fully as large as the above.

Many of my readers will be astonished at the magnitude of this trade; I myself was surprised at its great extent. I knew before that it was carried on on a large scale here, in Hungary, and in Germany, but I never dreamed that it was so extensive.

Why do not we Californians and brother planters try this trade? Our soil is much richer than that of Europe, and the method of drying the prunes is comparatively easy. We might, with the greatest ease, furnish all America, North and South. Why bring our goods from afar when we can procure them at home? When I have thoroughly made my investigation, I will give, at some future day, the modes of preparing these prunes as practiced here and in other parts of Europe.

Having fully investigated this house, we went to the chateau of M. de Luze. It is within half an hour's walk from his office. The chateau is an old family residence, lately repaired and ornamented under the direction of the old gentleman, who prides himself on such things, and displays very good taste. Surrounding it is a very fine park, which procures him all the pleasures of a country residence. The furniture of the chateau is all in the style of Louis XIV. and Louis XV., and is in the very best taste. We had a very good dinner, and a still better wine. We were here again made to drink of all the best years and of the best growths. The old gentleman lives in an elegant style, showing that the wine business is much better, in way of revenue, than that of many ducal estates. We left our kind host late in the evening. To-morrow we will visit Chateau Margaux.

September 18.—This morning we hired a carriage, and, accompanied by M. de Luze's nephew, we went to see the wine country. We stopped at the village of Margaux, about eighteen miles from Bordeaux. This is the wine district which has the greatest rep-

utation in all France. It is here that the renowned "Chateau Margaux" is made. The soil is gravelly, and intermixed with a great quantity of pebbles. It is of a gray color, some clay, but more sand. The grapes near the village are small and blue. The vines are kept low, being on trellis-work only two feet high. They are three feet apart each way. The vines are nearly all sulphured. The *oïdium* rages here. The frost in the beginning of the spring did much harm.

After having breakfasted we went to the Chateau Margaux, which is on the borders of the village. It consists of about eighty hectares, and belongs to the Marquis Aguado. The *regisseur* reluctantly gave his consent to us to see the place. However, he sent us to the head cooper, who was to show us around. We entered a long room, supported by pillars in the centre. There were but a few barrels here. In bad years it is here that the wine is kept. In good years the wine is sold immediately upon coming from the tanks or fermenting-tubs, or but a short time afterward. The country being all flat and near the river, no cellars are made. We were led into the room where the wine in bottles is kept. It is about sixty feet long, narrow, and very well arranged to pile up bottles. The divisions are of stone, and each contains about 200 bottles.

The press-house is also very well arranged. There are seventeen large fermenting-tubs on one side of the room. The other contains four large stone vats, one foot deep and twelve feet square. In the middle of two of these there are two round presses. The sides of these are composed of perpendicular slats two to three inches wide, and as many thick. They are placed wide enough apart to let out the juice, but not the seeds and skins. In the centre is an iron screw, which is worked from above.

The grapes, when brought from the vineyard, are thrown upon tables whose bottoms are made of slats crossing each other at right angles, and permitting the grapes to pass between. As soon as they are on these tables, the workmen, with the flat of the hand, rub them against the bottom. The berries by this operation fall through the slats, and the stem remains. It is immediately picked out and thrown in a tub placed for that purpose.

The fermentation lasts from seven to ten days. Then the wine is taken off, the residue put into the press and pressed. This forms the second quality wine. When the second quality has been made, the matter pressed is again thrown into a large fermenting-

tub and fermented, after water has been poured upon it. This latter wine forms the drink of the workmen of the establishment. There are about 400 barrels made per annum.

We visited one more domain, Chateau Rauzan, with its vineyards, presses, etc. It was about the same thing as the former, with the exception that the tanks were not in such good order, and that the slatted tables were over the fermenting-tubs instead of on the tanks. The grapes are thrown upon the tables by shovels. When rubbed from the stems then fall into the fermenting-tubs, where they are stamped by men. The rest of the wine-making establishments are conducted in nearly the same way.

I was really astonished how they could make any wine at all, the vines were so much affected by disease. Sulphuring must be very costly. Many vineyards will not make a single barrel of wine this year for the reason which I have already stated, that the frost killed nearly all the vines in the beginning of spring. The whole district of *Cognac* will not this year produce ten barrels. The proprietors, however, take it very coolly, saying that they will make it all up next year.

The land lying between Chateau Margaux and Bordeaux is in many parts sandy, and large tracts lay idle, not even producing grain. Other parts of these sandy tracts are planted with pitch pine. The older parts of these plantations yield turpentine. We returned in the evening much fatigued.

The following extract from Victor Rendu's *Ampelographie Française* will give a more correct idea to the reader of the country and its wines:

THE WINES OF BORDEAUX.

The wines bearing the general appellation of Bordeaux wines, because they grow in the country surrounding this celebrated emporium, and are shipped to all parts of the world from its harbor, are divided into four principal classes:

1. *Vins de Medoc.*—Wines of the Medoc district. Of these we shall treat in detail hereafter.

2. *Vins de Grave.*—Wines growing on the gravelly soil in the immediate neighborhood of Bordeaux, and on both sides of the rivers Dordogne and Garonne, within a certain distance of their confluence.*

* Of the red wines grown on this soil the most renowned are those of Chateau Haut-Brion. Of much less note are the wines of Merignac, Carbonnieux, and Leognan. Among the white wines the most popular are the Sauternes, the Barsac, the Preignac, and the Bommes. Again, among these, the most superior is the white wine of Chateau Iquem, in the parish of Sauterne, which has been sold up to 1200 francs per tun.

3. *Vins des Côtes.*—Wines growing on the range of hills at the right side of the Garonne, from Ambares to Saint Croix du Mont. Also on the right side of the Dordogne, between Bourg and Fronsac. Of these wines, the most celebrated are those of St. Emilion. Less choice are those of St. Laurent, St. Hippolyte, St. Christophe de St. Georges, and of Pommerol. The soil in these vineyards is generally a combination of lime and clay, with a subsoil of hard rock. They generally decline toward south and west.

4. *Vins de Palus.*—Wines growing on the bottom-lands of the Garonne, near Bordeaux. These are less distinguished than the above, although they are wines of a fine color and a good deal of spirit. The best of them are grown in the communes of Queyries and Montferrand.

Wines of the Medoc District.

The small peninsula formed by the River Gironde on its eastern side and the Atlantic on the western, is generally allowed to contain some of the finest vineyards in the world. This is the renowned Medoc district. It offers itself to the eye as a softly-undulating plain, with gentle declivities all along the river, and sandy downs, frequently interrupted by marshes and lagoons, along the sea-side. It is principally on those slopes above the Gironde where the famous Bordeaux wines are raised in their greatest perfection. The general formation of the soil consists here of a compound of quartzose fragments with clay, strongly impregnated with oxide of iron. This uppermost stratum rests either on a bed of pure sand, or on a conglomerate of gravel with clay, and a strong admixture of iron oxide, which composition—very hard in some cases, and soft and crumbling in others—goes by the local name of "alios."

This diversity of the soil, or, rather, the great variation in the mixture of its component elements, is the principal cause for the great diversity of its productions. As a proof of this, we find, in many instances, wines of inferior quality in the close neighborhood of the very best vineyards, and, *vice versâ*, streaks of good soil amid poor vineyards, giving a much better wine than the surrounding grounds. The culture of the vine in the Medoc district varies more or less from the methods used in other parts of France; but the training of the vines on laths or on trellises near the ground is a characteristic not to be found any where else but here.

The most extensively cultivated grapes in the Medoc are the Cabernet-Sauvignon, the Franc-Cabernet, the Meilot, the Malbec, and the Verdot; but it is especially the Cabernet-Sauvignon which forms the basis of the Medoc vineyards, and, in fact, is to the great Medoc wines what the Pineau is to the wines of the Côte d'Or in Burgundy. This unsurpassed grape is the chief ingredient of the celebrated wines of Panillac, St. Julien, and Margaux; and about

five eighths of the plantations of Lafitte, Mouton, Latour, Leoville, Margaux, Rauzan, etc., belong to the same. The wine made of it is of a splendid color and an exquisite bouquet. A little tart at the beginning, it requires to be kept in wood for four years, and then for two in the bottle, to arrive to its full maturity. It gains in excellence up to its fifteenth year, and preserves all its qualities till the twentieth; beyond this it loses gradually some of its smoothness, and becomes more and more dry.

The method of cultivation is uniform all through the Medoc district, and does not present any striking difference from the methods pursued in other parts of France. The vines are generally planted from April to June. The distance observed is one metre and ten centimetres between the vines on one and the same line, and only one metre between the rows. In the second year the vine is pruned to two or three eyes; in the third it begins to be trained on a trellis by tying two sprigs, each with two or three eyes, to the lath. The pruning commences usually in November and lasts till January.

In the Medoc district the vine is in blossom in the middle of June, and the grape ripens, in favorable years, about the middle of September. In such years the vintage begins on the 20th of September and lasts to the 1st of October. If it takes place altogether in this month, the year is pronounced to be middling or bad. Every body may gather his grapes when he pleases, as there is no time fixed by statute for this purpose in the Department of the Gironde, to which the Medoc district belongs.

The grapes are carefully picked, and cleaned of green or rotten berries before they are taken to the press-room. Here the wine-presses stand, generally three of them, ranged on one side, and the vats along the opposite wall. The berries are all plucked from their stalks, which is done either with rakes or an instrument called an *egrappoir*. After this they are trodden down in tubs, which generally have a hole in the bottom through which the must escapes. This is taken to the vat, which is scrupulously cleaned and sponged with brandy. The vat being once full, must be left perfectly quiet until the wine is formed, which may take some four or five days, or even longer, according to the temperature, weather, ripeness of the grapes, etc. As soon as the must has lost its sugary taste, and has turned fairly into wine, it is drawn carefully into casks, during which operation great care is taken not to let any foreign matter be mixed with the pure juice of the grape. The filling of the casks must be done as quick as possible. During the first month they must be filled up every four or five days; the second month, once in eight days; and subsequently once in fifteen, until the wine is drawn off. This has to be done three times during the first year, viz., in January or February, in June, and in September. In the following years it is sufficient to draw off only twice. Ordinarily, the Medoc wines are

left four years in the cask before they are bottled; and in two years more they will be perfectly mellow and ready for the market.

The Medoc district contains about 20,000 hectares of wine-land. The average produce is at the rate of two tuns (say 18 hectolitres and 24 litres) per hectare, amounting in all to 40,000 tuns. Of this quantity about 4500 belong to the first class wines, an equal quantity to the second but still superior class, and the balance to ordinary wines.

The superior wines of the Medoc are classified in the Bordeaux commerce into five different qualities. The first class contains only three wines, which are ranged as follows:

1. Chateau Margaux, 100–110 tuns per year.
2. Chateau Lafitte, 120–150 tuns per year.
3. Chateau Latour, 70–90 tuns per year.

The vineyard of Chateau Margaux contains 80 hectares. The soil consists of a gray gravel, with a substratum of "alios." The greater part of the vineyard looks toward east and west, but the best part of it inclines to south and north. The Cabernet-Sauvignon vine occupies about one half of this celebrated vineyard. In a first-rate year the wine of Chateau Margaux surpasses by far every other Bordeaux wine, even Lafitte and Latour not excepted; but in less favorable years these two wines are superior to their great rival. The chemical composition of the soil of this famous vineyard is as follows:

Oxide of iron	3.341
Alumina	1.590
Magnesia	0.263
Soluble silicates	0.380
Phosphoric acid	0.147
Potash	1.291
Carbonate of lime	0.891
Organic matter	6.670
Insoluble residue	85.427
	100.000

The vineyard of Chateau Lafitte contains 47 hectares. Its situation is various, but mostly northerly. The soil, and especially the subsoil, is very rich in quartz pebbles. Chateau Latour contains only 42 hectares. Its soil is very gravelly, and inclines mostly toward south and north.

The second class of Medoc wines comprises the following vineyards:

De Branno-Cantenac	45 hectares,	50 to 60	tuns	per	annum.
Cos-Destournel	28 "	60 " 70	"	"	"
Duport de Vivens	32 "	30 " 35	"	"	"
Gruaud-Larosse	51 "	100 " 120	"	"	"
Lascombe	21 "	15 " 20	"	"	"
Leoville — Lascases	65 "	80 " 100	"	"	"
Leoville — Poyferé	30 "	40 " 50	"	"	"
Leoville — Barton	25 "	25 " 70	"	"	"
Mouton Rothschild	52 "	120 " 140	"	"	"
Prichon de Longueville	50 "	100 " 120	"	"	"
Rauzan-Rauzan	51 "	70 " 80	"	"	"

To the third class belong the following vineyards:

Issan	43 hectares,	50 to 70	tuns per annum.
Desmirail	14 "	30 " 40	" " "
Philippe-Dubignon	13 "	15 " 20	" " "
Beau-Caillon	35 "	100 " 120	" " "
Fruitier	38 "	60 " 70	" " "
Ganot	16 "	20 " 25	" " "
Giscourt	45 "	80 " 100	" " "
Kirwan	24 "	35 " 40	" " "
Lagrange	122 "	120 " 150	" " "
Langod-Barton	70 "	100 " 120	" " "
Pouget et Chavaille	11 "	25 " 30	" " "
Lacotonie et Malescot	50 "	70	" " "

In the fourth class are reckoned

Talbot	69 hectares,	70 to 80	tuns per annum.
Beycherelle	40 "	100 " 120	" " "
Calon-Lestapis	55 "	120 " 160	" " "
Carnet	52 "	100 " 120	" " "
Casteja, or Milon	30 "	60 " 70	" " "
Dubignon		12 " 15	" " "
Duluc, aine	60 "	80 " 90	" " "
Verrieres	8 "	10 " 15	" " "
Rochet	22 "	30 " 40	" " "
La Lagune	36 "	40 " 50	" " "
Solberg	30 "	25 " 30	" " "
Pagès au Prieure	11 "	25 " 30	" " "
Palmer	85 "	50 " 60	" " "
St. Pierre	18 "		
	9 "	50 " 70	" " "
	9 "		

Lastly, the fifth class contains, among others,

Batailly	34 hectares,	60 to 80	tuns per annum.
De Bedout	17 "	50 " 55	" " "
Canet-Poutet	67 "	100 " 120	" " "
Cantemerle	91 "	120 " 130	" " "
Jurine	40 "	100 " 120	" " "
Ducasse	33 "	80 " 90	" " "
Le Grand Puy	52 "	50 " 60	" " "
Montpelouss-Casteja	14 "	25 " 30	" " "

The prices of all these wines vary, of course, according to the years and the demand. They arrived at their maximum in 1844, when Lafitte was sold at 4500 francs the tun, Haut-Brion at 3000, Mouton at 2500, Lagrange at 1900, Kirwan at 1850, Giscourt at 1800, Langod-Barton at 1600. In ordinary years the second quality wines are sold at from 1200 francs to 1400 francs the tun; the third quality at from 800 to 1000; the fourth for only little less; and the fifth, on an average, at 600 to 700. The first quality of Chateau Margaux have been contracted for nine years at the price of 2100 francs per tun, but the princely Chateau Lafitte generally sells at a much higher rate. Of the inferior wines, the better class (*Bourgeois superieurs*) are worth 400 to 500 francs a tun; the second class (*Bourgeois ordinaires*), 350 to 400; and the third (*Paysans*), 300 to 325 francs.

The best customers for the Medoc wines are the English, the

Dutch, and the Russians. Those exported to England are generally qualified for the British palate by being mixed with stronger wines, and especially with the red wines of the Ermitage district.

M. Franck, who has published an elaborate work on the great Bordeaux wines, quotes the following prices at which some vineyards of the Medoc have changed hands.

Chateau Margaux (80 hectares), bought, in 1804, for 651,000, was sold in 1836 to M. Aguado for 1,300,000 francs.

Malescot (Margaux), in 1853, for 280,000 francs.

Gruaud-Larosse (St. Julien, 51 hectares), in 1814, for 350,000 francs.

Langon (St. Julien, 40 hectares), in 1851, for 650,000 francs.

Beycherelle (St. Julien, 40 hectares), for 650,000 francs.

La Grange (St. Julien, 122 hectares), in 1832, for 650,000 francs; in 1842, for 775,000 francs.

Lafitte (Panillac, 67 hectares), in 1803, for 1,200,000 francs.

Mouton (25 hectares), bought, in 1853, by M. Rothschild for 1,125,000 francs.

Baye, for 300,000 francs.

Batailly (34 hectares), for 150,000 francs.

Calon (St. Estèphe, 55 hectares), for 600,000 francs.

Du Bosq (St. Estèphe), for 190,000 francs.

Chateau d'Issan (Cantenac, 43 hectares), sold, in 1825, for 255,000 francs, was, in 1859, adjudged to the heirs of the Blanchy estate for 470,000 francs.

Lacheney (Cussac), for 150,000 francs.

Laujac (Bégadan), for 400,000 francs.

Haut-Brion (Persac), for 525,000 francs.

Giscourt (Labarde, 45 hectares), for 500,000 francs.

Cos-d'Estournel (St. Estèphe, 28 hectares), for 1,150,000 francs.

Palmer (Cantenac, 85 hectares), for 425,000 francs.

Chateau d'Agarsac (Ludon), for 891,000 francs.

The same author, speaking of the Champagne and its wines, says:

The wine-growing country of the Champagne district may be properly divided into two topographical arteries: First, the hills on the River Marne; and, second, the mountain of Rheims. The first is again ramified into three different ranges: 1. The northern side of the river, with the hill-sides looking due south, and to which belong the distinguished vineyards of Hautvillers, Disy, Ay, and Mareuil. 2. The opposite side of the river, which includes the vineyards of Epernay, of Moussy, Pierry, and Vinay. 3. The range of Avize, running in a southeasterly direction, parallel with the *côte* of Epernay, and containing the vineyards of Cramant, Avize, Oger, Mesnil, and Vertus.

The second general division of this great wine-district embraces all the vineyards in the environs of Rheims, and is subdivided into two zones: 1. The hilly part, containing Verzy, Verzenay,

Sillery, Mailly, Londes, Chigny, and Rilly; 2. The flat zone, with St. Thierry, Marsilly, Hermonville, and others. Besides these there is a small intermediate tract between the plain and the mountain, where the gentle declivities of Bouzy and of Ambonnay are to be found.

Most of the noted vineyards of the Champagne are situated on a formation of limestone and chalk, covered by a generally very superficial structure of vegetable mould. The soil may be said to contain fully four fifths of carbonate of lime, and only one fifth of clay, silicious and other matter. Oxide of iron also enters into its composition in several instances.

The vines mostly cultivated belong to the family of the Pineau, and generally bear dark grapes. They vary, however, to some extent from the original Pineau (or Pinot) of the Burgundy district, probably on account of the diversity of the soil in these wine-districts.

The cultivation of the vineyards is nearly uniform through all the province, but it may be said that at Ay it has been brought to its highest perfection. December is the best month for plantation, although it may be continued even to the end of March. The ground is always manured at the time of planting. The young plant, generally a rooted vine two or three years old, is dug round four times during the first year. In the second year it is pruned down to one or two eyes, according to the vigor of the plant, and the soil is worked up again four times in the course of the year. In the third year a certain proportion of the most vigorous plants are used. When in bearing order the vine is generally kept low, and tied to a stick.

The vines are in blossom about St. John's Day, and are carefully freed from all new sprouts (*gourmands*) after this time. The grapes arrive at their full ripeness in September, and the vintage begins, in favorable years, in the middle of this month; in less favorable ones at the beginning of October; and in bad years not before the middle of the same month. Every body is at liberty to gather his grapes when he pleases. The grapes are carefully picked by women, and cleaned on the spot from all spoiled berries, leaves, etc. Then they are carefully selected according to their ripeness and perfection, and sent to the press-house.

The manufacture of wine has been raised to the proportions of a particular art or science in the Champagne district during the last fifty years, and forms a special industry, frequently entirely separated from the culture of the vine. Nearly all the wine produced in this district is made into sparkling wine; and the formerly celebrated brands of dry Champagne wines—namely, the red wines of Sillery, of Bouzy, Verzenay, and Mailly—scarcely exist any more in commerce. The same black grape which was the mother of these dark wines yields at present the juice for the pale wine, which, in its sparkling state, ranks uppermost in the estima-

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tion of the wine-consuming public. In some vineyards in this district, however, white grapes are planted in preference to the black ones, and it has been ascertained that if judiciously mixed (say one eighth to one quarter of white, the balance of black grapes), they add to the excellence of the wine, made into sparkling Champagne.

The grapes must be passed very rapidly through the winepress, to avoid all fermentation in the berries, and all coloring of the must. The must is not immediately barreled, but left for from twelve to twenty-four hours in vats, so that it may deposit all its coarser dregs; then it is drawn into scrupulously cleaned and sulphured barrels. In these the wine generally ferments until Christmas. If rich in sugar, this fermentation will progress very slowly, and will be the more rapid the less sugary particles the must contains. In the second half of December the wine is drawn off for the first time, without taking any notice of the particular state of the atmosphere. Now is the time to test the quality of the wines, and to mix the different qualities, or, in some cases, wines of different vineyards and localities judiciously together, so as to obtain the most perfect mixture. After this operation the wine is cleared with gelatine, and then drawn off again through a double sieve of hair and silk which is placed on the funnel. By this the entrance of all foreign matter will be avoided. Generally, very little gelatine is used; but in most cases a little tannin in the liquid state is added to the wine as a preservative against various maladies. In this condition the wine remains till the month of April, when it is drawn off again for the purpose of being manufactured into sparkling Champagne.*

The white wines of Champagne are classified into the "Great Sparkling Wine," *Grand Mousseux;* the "Ordinary Sparkling Wine," *Mousseux ordinaire;* the "Half Sparkling Wine," *Demi-Mousseux*, or *Crémant;* the "Non-sparkling," or "dry" Champagne, *Non Mousseux;* and a very light, weak, sweet, and slightly sparkling quality, called *Tisane de Champagne.* The sparkling wines attain their full maturity in the third year after being bottled, and will lose nothing of their sparkling quality within a dozen years. The half sparkling wine, if of a good source, is considered by connoisseurs as the king of all white Champagne wines.

In first-rate years the Champagne district will produce not less than fifteen million bottles of white wine, and the average production may be rated at seven millions per annum. This commerce has been rapidly increasing for about forty years. The principal markets for it are England, Germany, and Russia; and the names of the great manufacturers, Moët, Cliquot, Ruinart, Roederer, Piper, Perier, Dinot, are well known all over the world.

Having completed our observations on the famous wine district of Bordeaux, we prepared to take our departure for Spain.

* A minute description of the *modus operandi* in the most renowned factories of the Champagne district is given in another part of this work.

CHAPTER VIII.

JOURNEY THROUGH SPAIN: WINE, RAISINS, AND OLIVES.

Departure for Spain.—Delay for Passports.—Country between Bordeaux and Bayonne.—Shepherds on Stilts.—Bayonne.—Loading Revolvers.—Napoleon at Hand.—Start by Diligence for Madrid.—The Diligence.—The Driver and the Mules.—The Postillion.—On Spanish Frontier.—Ascent of the Pyrenees.—Desolate Aspect of the Country.—Breakfast.—Water and Towel.—Another Inspection of Baggage.—A Municipal Misunderstanding.—Burgos.—The Railway.—Passengers bound for a Bull-fight.—Delay.—Train full.—Passengers left behind.—Change Cars.—Delay again.—Refreshments.—Arrival at Madrid.—Our Hotel.—Compassionate Waiter.—The Fair.—The Royal Palace.—The Prado.—The Fountain.—General Description of the Country traversed.—Product.—Execrable Wines.—Leave Madrid for Malaga.—Delay.—Difficulty about Baggage.—Finally settled.—Off at last.—Stopped again.—One Passenger too many.—A Discussion.—The extra Child.—A Night Ride.—Morning.—Beggars.—Vines appear.—Ordinary Spanish Wines very poor.—The Boy again.—Building a Railway.—Barren Country.—A beautiful Valley.—Dinner at Victoria.—Arrival at Granada.—See the City.—Our Carriage.—The Sights of Granada.—Beggars.—Start for Malaga.—Notes by the Way.—Malaga.—Wine and Raisins.—Making Raisins.—The Drying-grounds.—Picking and Packing.—Malaga Wines.—Vinegar-making.—Fig Culture.—Horse-fight.—Apprehensions of Damages.—Manufacture of Olive Oil.—Cotton and Iron Manufactories.—Buy Plants.—Goat-milk.—Passports again.—Depart for Alicante.—Aspect of the Coast.—Alicante.—Barcelona.—Wine-making.—Leave for Paris, *via* Marseilles and Lyons.—Arrival at Paris.—Give up Project of visiting Greece and Egypt.—Start for Home, *via* England.—Arrive in America.

September 19.—We were very much annoyed by the trouble we had in getting our passports viséd. Our consul shuts up his office at three o'clock, and if an unfortunate American should not arrive at that hour, no matter who he be, there is an end of it, he has to wait twenty-four hours longer, for none of the other consuls will visé his passport before seeing that of the American consul. At eleven o'clock we went to our consul's office, but found him absent. The lad in attendance told us that he was maybe sick, and at his house. We persuaded the lad to stamp our passports, that we might afterward take them to the consul and have them signed. This he did, and then asked us for eleven and a half francs, which is more than we had ever given. We went to the consul's house, where, after knocking and ringing violently, the door was opened by some invisible hand; we walked

into a hall and through several empty rooms; at last we discovered a little girl, who was the consul's daughter. She informed us that her father had left for his office in the morning; that if he was not there she did not know where he was. This was very disagreeable news to us; for, had it not been for our passports, we could have started at six o'clock in the morning, but we were delayed by this for the two o'clock train, and, from all appearance, would be liable even to miss that, and be left here over-night. This was uselessly wasting time, which was most precious to me, to say nothing of extra expenses. Returning to the office, and not finding the consul, I suggested to the lad to sign it himself, and state the absence of the consul. This was not legal, nor had the boy any authority whatever to do it; but, thinking the whole affair a *fuss*, and that the principal part was passed—namely, of taking the eleven and a half francs, I saw no harm in making the *fuss* bigger. The lad, after some hesitation, signed; we then proceeded to the Spanish consul, who, after stamping and signing, asked us for ten francs. We arrived just in time for the cars.

We were traveling eight hours from Bordeaux to Bayonne, and a more desolate and dreary country I have not seen since my arrival in Europe. It consists of immense plains, which are sandy, and only now and then possessing some pitch pine. Even these trees are of recent plantation. They are employed in making turpentine. These *landes*, as they are called, produce a kind of chapparal, but it is only from a foot to eighteen inches high. On these plains there are now and then seen some miserable sheep, guarded by men or women on stilts. As their flesh is so poor, what must their wool be? They resemble very much our Mexican sheep, only they are not so large nor so good-looking. But of all that is here seen, it is the stilts of the shepherds that is most noteworthy: they are from four to five feet high, and their owners remain on them the whole day without getting down. From this height they are better able to see their sheep in the bushes, and walk through the mud when there is any.

We arrived at the hotel at ten o'clock, and soon turned in.

Sept. 20. *Bayonne.*—In the morning we took a walk through the city. We visited its monuments and markets; in the latter the vegetables were very fine, and the grapes good and sweet. We ascertained that very little wine was raised in this vicinity.

In the River Gave, which runs through Bayonne, were anchored several large vessels. The two parts of the town are join-

ed by a very fine bridge, newly built. The fortifications that lie on both sides of the river seem quite strong. After exchanging our money for Spanish coin, we went and engaged our places in the diligence office for the capital. Here we learned that the stage was to leave at six o'clock. Among several other items of disagreeable news, we were informed that it would take two nights and two days to reach Madrid, and, what was as bad, very little time was allowed to us for our meals. Besides this, we were told by every one whom we questioned that the roads were bad.

At ten o'clock a most sumptuous breakfast was served up. It by far surpassed many of our holiday dinners at home, if not in cooking, at least in variety.

After breakfast I wrote up my journal, some correspondence, then set out in search of a gunsmith to load my Colt's revolver, for I feared that I might have some use for it in Spain. The ticket-seller told me that it was pretty safe; but, as I read on my ticket, "*The Company is not responsible for any effects taken by armed force*," I thought "discretion the better part of valor," and had my pistol well loaded. With an eight-inch "Colt," I thought I might meet on pretty equal terms quite a considerable "armed force."

The Emperor Napoleon is at this moment in the bathing-place of Biarritz, about twenty minutes' drive from here. To-day he is expected to pass by Bayonne on his return to Paris, and all along where he is to pass the road is decorated with flags, flowers, garlands, and arches of triumph. Great enthusiasm is every where shown, and, from all I here saw, he is very much loved in this part of France.

Precisely at six in the evening we started with the diligence. There were about twenty passengers, and a quantity of large trunks, some of which would hold the whole household furniture of six families living out West. Besides these immense trunks there were several dry-good boxes belonging to some merchant passenger, which attained still greater dimensions. With all this weight, the six powerful horses hitched to our diligence took us along at a good sharp rate. At the first station we again took six horses. When I speak of a diligence, let not my readers imagine an American stage; it differs in every respect.

The wheels are large and heavy; the box, which is painted in a tasty manner, is divided into four divisions, each having its own entry and its own price. These divisions, naming them by the

order of their rank and price, are the *Berline*, *Interieur*, *Rotonde*, and *Coupé*. In the Berline there are three places, all fronting the horses, having each a window in front, and the two side places one on the side. After the Berline, which is in the front of the diligence, comes the Interieur. It has six places, three toward the front and three opposite. The four side places have each a window. Like the Berline, the Interieur has two entries, one on each side. The Rotonde possesses four places, two on each side of the carriage, and parallel to it. Behind each place there is a window, and the entry is from behind. In front, on a level with the top of the diligence, is the driver's seat. Right behind this is the Coupé. It has four places, one for the conductor, and three for passengers. It is covered by a thick covering of leather, of the exact shape of an old American buggy. Behind this was the roof of the diligence, on which the baggage was put; and, after being firmly lashed on, covered over with a thick covering of leather. Sometimes it happens that all the space under this covering is not taken up by the baggage; it is then used to stow away passengers who travel as fifth class. The only light, the only air these poor fellows get, steals itself through the little hole behind the conductor's seat, which also serves as door. They have not even a bench to sit upon. It is useless to say that this is the cheapest place. The Coupé, in price, comes after the Rotonde. We chose our seats in the Coupé. At the end of our journey, far from repenting of our choice, we found that it was a most happy one; for, while the other passengers were half suffocated from dust and the want of air, we suffered from neither. The only objection of our seats was the difficulty to get out and in: this difficulty was much heightened by a woman who had a child in her lap, and who occupied the third place in the Coupé.

At the next station they hitched on thirteen mules, and away we went, full gallop up and down hill, the driver hallooing, shouting, yelling, and cracking his whip. His yells would have done honor to an American savage. What, however, most astonished me was the driver's descending and mounting to his seat while the mules were in full gallop. It was at least ten feet above the ground. When his mules would not pay any more attention to the cracks of his whip or to his voice, he would quietly descend, and, after whipping them from the last to the first rank, all the while uttering the most unearthly sounds, he would climb quietly up to his seat again, although the whole equipage might

be on a full run. No sooner would he be in his seat than he would recommence his yells, and ply his whip most vigorously. There is on the leading mule or horse a postillion, whose only duty is to halloo to wagons and carts which are met to turn out of the road. It is a curious sight thus to see twelve to sixteen mules, in two or in three rows, going along with all their speed, the two last only having lines, the others tied one to another by their halter-strings. The postillion has a control only over his own mule and the one beside it. Such a scene is as hard to describe as it is curious. Although the postillion only controls the first two mules, and the driver the last two, they dash away at the greatest speed, plying their whips, shouting, yelling, bawling. When the driver gets down to whip the mules, the conductor takes his place, whips unmercifully all those he can reach, and screams at those he can not reach. When an unaccustomed traveler sees himself carried along at such a rate, on the brink of precipices from two hundred to six hundred feet, by twelve to sixteen mules without reins, he involuntarily shuts his eyes, and recommends his soul to its Maker.

We arrived at about ten o'clock in the evening at a place where we were asked for our passports by the French authorities, who scarcely gave them a glance. We crossed a bridge and were in Spanish territory. Here we got out to have our baggage thoroughly examined, as well as our passports, by the Spanish authorities. For having the latter again viséd we were obliged to pay once more. We might have dispensed with their visé, but they could not have done without our *reals*, for they were a most hungry-looking set.

After uselessly spending two hours here, we resumed our course, drawn on by sixteen mules. It was a fine moonlight night, and I could see the country all around. We were ascending the Pyrenees. In the ravines was planted Indian corn. The hills are barren, and have few, if even any trees on them. Soon it began to rain, and I could no longer see out. At twelve o'clock we arrived at St. Sebastien, where we were nearly upset in trying to get through a gate. The string of mules was so long that they could not give the proper turn, and the gate was so narrow that we ran up against one of the posts. At last, after a few moments of hallooing and whipping, we got through. We changed mules and continued our way, which ran along the sea-shore for about half an hour, then left it for good.

September 21.—We traveled the whole night in the same way as above-mentioned. The morning brought to our view a mountainous and unimproved country. It was as wild as the Rocky Mountains. The ravines were the only part of the country which was cultivated, and they were planted with Indian corn and chestnut-trees.

The houses of the villages are all of stone, but they have a most wretched and miserable appearance. Poverty, dirt, and laziness are every where to be seen. The fields are not cultivated with the same care as in Switzerland. Here and there you meet patches of turnips, some of which are hoed by women, but this must be considered so much work thrown away, as they generally are not hoed at all.

At eight o'clock we arrived in a village where we expected to have a good breakfast, and, after such a ride, by all means a good wash. To our great disappointment, we had neither the one nor the other. Water there was plenty in the well; and as for the good breakfast, it reduced itself down to a cup of chocolate and something which we were told was coffee. We did not choose to experiment, so we chose the chocolate, which was in a little cup, two inches in diameter and three deep. These measures were reckoned on the outside of the cup, not on the inside. For this they charged us the moderate sum of ten *reals*. It is such an unaccustomed thing, without doubt, to see persons wash in this country, that they thought if we could wash we could pay.

After this sumptuous breakfast we went on again, and about eleven o'clock we reached the valley. It is large, extensive rolling ground, having no trees and looking like a desert. There is some grain grown, which consists of oats, barley, and a little wheat, but no corn. The grain is all planted in rows, and hilled up, like corn out West, only on two sides, not all around. The planting is done by dropping the seed after the plow has raised up the ground. I could not ascertain what an acre yielded, for no one either in the stage or in the village could inform me.

At one o'clock we arrived at Vittoria, where we got a kind of dinner. We even had the luxury of getting one towel for eight of us. Happy was he who found a clean corner! Thirty minutes after, we were again on the way through this dreary, desert-looking country. It is uninteresting, altogether without trees, and has not even a sign of cultivation. There are no houses on the plains; the villages are small, dirty, and miserable-looking; the

houses have no windows to them except some few; the means of transportation is by mules, donkeys, and miserable two-wheeled carts. The cart-wheels are made wholly of plank, and then an iron tire is put on. We saw neither carriages nor wagons, but we met now and then a large two-wheeled car, with eight to sixteen mules hitched on, one in front of the other, stretching out a long way.

On our left I saw men working on the railway which is eventually to go from Bayonne to Madrid. Even this enterprise is carried on by Frenchmen.

We sped on at the expense of the lungs and whip of the driver and conductor. Neither the one nor the other were spared. I thought that the whip bill would be very dear to the company, but I learned that the driver furnishes his own whip. We arrived in a dirty little town, where, to our great astonishment, we were told to get out to have our baggage again inspected. I tried to ascertain the reason for twice inspecting your baggage in the same country, but I was unsuccessful. "It must be done;" that was all I could learn. After inspecting us as well as our trunks, they permitted us to go on. We almost got ourselves in trouble before leaving this place; for, as we were going along its street at a sharp walk, up jumped a man of authority telling the driver to stop, and accusing him of trotting in the street. The conductor, driver, and postillion all protested against this false accusation. A dispute arose; high words ensued; and then the man of authority threatened to sue the conductor, driver, postillion, and even the passengers. Hearing this, and foreseeing the little chance of justice here, I suggested to the conductor to put an end to all lawsuits by driving on, and this time at full speed. He took the hint, and away we went, scattering all the men of authority right and left, none venturing to stop us. That was putting an end to a lawsuit pretty quick, and for once again we were out of trouble. The country through which we passed was just the same as I have already described above.

September 22.—We arrived at Burgos, at the railway station, at four o'clock in the morning. Here our whole diligence, baggage and all, except passengers, was hoisted upon a car, and fastened to it. We were furnished seats in the cars. I was very much astonished at seeing such a great number of people at the station, and especially so, because Burgos did not seem large enough to furnish so many travelers. There was an immense mass of men,

women, and children, all crowding toward the ticket-office. When the doors were open, there was a general rush and scramble for seats. The enigma was soon explained to me. It was not Burgos alone that produced all this people, but the whole country around; they were all bound for Valladolid, where there was to be a bull-fight lasting four days.

We were unable to get the least thing to eat at Burgos. At the next station all the extra cars were put on, but they were hardly sufficient to hold all the people here, who were also on their way to the bull-fight.

The master of the train, conductor, and other officers ran right and left, swore, cursed, blasphemed, thus making the confusion tenfold greater and the delay much longer. The consequence of all this was that we only got off one hour and a half later than we should have done by the regulations. The train at last started, but, being more than the locomotive could easily draw, our progress was slow. At the next station hundreds were waiting to be taken in, but the master of the train only went slow enough to tell the chief of the station that there were no more places, as all was full. Though the cars were in motion, no sooner was this heard than there was a general pursuit, some succeeding in scrambling into the cars or gaining the top. This was followed by a general groaning and cursing from those who were unsuccessful, and loud cheers of hurrah from those who had succeeded in getting in or climbing on top of the cars.

I pitied the poor ticket officer. As I turned round my head in that direction I saw already a crowd forming round him, making most violent gesticulations—no doubt asking back their money, with damage and interest for bets which they never would have made. If physiognomy shows the workings of the human mind, that of the poor fellows who were left evinced the most bitter disappoinment. Napoleon witnessing the burning of Moscow could not have looked as deplorable as these poor people who were left.

We traveled six hours in the railway, after which we again got into the diligence, to which fourteen mules were put, and off we went. At ten o'clock P.M. we arrived at another railway station, where we learned that we were one hour too late. Our conductor swore at the manager, and the manager swore at the conductor, each blaming the other. At last they came to terms. It was mutually agreed that it would not happen again till next time;

and we were made to understand that a merchandise train would carry us to Madrid.

The passengers at first seemed to like the delay, for they had had nothing to eat for sixteen hours, and they thought it would be a fine opportunity to refill their empty stomachs. We all ran to the dépôt like so many famished wolves. But what was our disappointment when they informed us that the station was quite new, and that there was nothing eatable to be had. After a long hunt, we found, in a corner, a woman who sold *aguardiente* and some bad water.

Dear reader, you ought to have seen the faces of the Johnny Bulls, the Johnny Crapauds, your Yankee commissioner, and his starved secretary. The scale had turned; the chevaliers of the bull-fight would have burst into a laugh had they seen our ludicrous expressions. How we did "bless" the conductors and managers in general, and ours in particular! We walked up and down the yard in a rage, dining on the dust our feet kicked up, and having the beauty of the moon for dessert. At last the Spanish hour arrived which is marked two on my watch, and we were packed into the baggage train. Our diligence was along with us. The whistle blew, and we started.

Our train got in at the Madrid station at one o'clock in the morning. Here we again got into our diligence, and were wheeled to the office of the company in the city. The Custom-house officers detained us for a while, after which, to our great relief, we were allowed to go.

We went to the Hôtel des Ambassadeurs. Of course, every one was asleep. We managed, however, to get a room, and the waiter, seeing our forlorn looks, brought us a bottle of wine, and then, with great mystery, drew from his pocket two cakes, called *ladies' fingers*, from their size, no doubt, and, putting them beside the wine, told us that no charge would be made for them. Fatigued with our fifty-six hours' ride, we crawled into our beds, sure that we would not have the nightmare from an overcharged stomach.

September 23.—After ten o'clock A.M. we took a carriage and drove to the residence of the American minister, but found that he, his family, and secretary were at Lagrange, the summer residence of the queen. From here we drove round the city, visiting the palace, the gardens, the promenades, the Prado, etc. We also visited the fair, which was being held on the continuation of the Prado, on the edge of the city.

In this fair is offered for sale every thing which can be imagined used for household or domestic economy, from a spoon to a stove, a canary-bird to a hare, a needle to a dress, a ring to a diamond, a sheet of paper to a library, a knife to a plow; and, in fact, every thing which is made use of in domestic economy, as well as many that are not. I found nothing worthy of note here, and, in fact, I may say that Madrid fell far below my expectations. There are many provincial cities in Europe which are much handsomer.

The royal palace is large and very good-looking. It is very plain, having little ornament and no statues. The statues round the circular garden in front of the palace are none the better for wear. They are hewn out of some sandstone instead of marble, and represent the ancient kings and queens of Spain, besides some of its heroes. The garden itself is pretty handsome. The palace is on a splendid elevation at one end of the city, but what a dreary, barren waste is seen from it! This waste commences almost under the walls of the palace. There is nothing to relieve the eye; no green, no meadows, no woods, no gardens, no chateaux—not even farms. All that is seen is stubble-fields, and now and then a brick-manufactory. Even the queen's garden is of little consequence, and looks most sadly neglected. The streets are not better, if even as good as those of San Francisco. The world-renowned Prado has miserable old stumpy trees, half decayed, ill kept, and possesses dust enough to frighten any man who has black boots.

However, Madrid has one advantage over all Europe and America, and that is its fountain, which plays in the middle of the square of the city. It has no ornaments whatever, simply a basin, which is 100 feet in diameter, in the centre of which is an iron pipe about four inches in diameter. This sends out a stream of water which rises to 170 feet. Seen from a distance, it looks like snow curling up from the ground. The Botanic Gardens are in progress, and promise well.

But I have neglected to give an account of the country through which we traveled. It was a wide plain, cultivated with wheat, barley, and oats. The people live in villages; therefore from one town to the other there is nothing to break the monotony of the plain—no haystack, house, or even pile of rocks. The villages in the plains consist of low and miserable houses. In the streets there are probably one or two shops, the whole value of the place being $500, if so much.

We passed one village, which, with a few exceptions, was built in the ancient style of the renowned city of Petra, in Arabia; only, instead of being hewn in the rock, the houses, or rather cellars, are dug in a clay hill. Here in the cellars, without windows, the people live. In the rear of these habitations is a hole which serves for a chimney.

On the plains of New Mexico, famous for their numerous squirrels, their holes are called villages; but what shall I call this? my English is too defective to give it an appropriate name.

On approaching Valladolid, I saw some few vines planted, but without stakes, and allowed to grow as they pleased, having about five to eight feet distance between. They are plowed by a yoke of oxen; afterward the ground is piled up around them. Corn and potatoes are also planted. The soil is sandy and yellow; and the wine I tasted was most rascally stuff, being made worse by being kept in hide bags made of calves' skin. Vines continue to be planted in spots almost all the way to Madrid.

At eight o'clock in the evening we started from Madrid, on our way toward Malaga. We were drawn to the railroad dépôt by six fine gray horses. Here we all got out, and, to my great astonishment, the hundred buckles holding up the baggage were undone, and all taken off and put into the cars. The distance from the diligence office to the railway station was only from ten to fifteen minutes' ride, and I could not make out why all that trouble was taken to put on our baggage, when it had to be taken off again so soon. Why not give the passengers a rendezvous at the station? Much time and trouble would be saved them. To all my inquiries no one could give an answer. They have few practical ideas here at present. When all the baggage was removed the diligence was taken back to the city, where the horses will remain a day and a half idle.

After some whistling, backing, etc., we started, and soon lost sight of Madrid. The moon was beautiful, and, as I lay in my seat looking out of the window, I imagined myself back in New Mexico traveling in cars. There was, in fact, some resemblance, except that on the Plains we sometimes pass a cottonwood-tree; here not a bush could be seen. Passing several villages, all desolate and uninviting, we at last came to the place where we had again to take the diligence. It was two in the morning. When the baggage came into the baggage-room there was a general rush, each passenger laying his hands upon any

thing that came within reach, whether his own or not. When his hands were full, he hunted for the person who had his own, and then reclaimed it, making a mutual exchange. The scene was highly comical, and worthy the pencil of Cruikshank, or Cham, or M'Lenan. When all had reclaimed their effects, there was found to be one package unreclaimed. Here a long parley ensued between the conductor and the railroad officers. They counted and recounted all the luggage, but to no effect. The passengers were all called up, to see if any one would claim the package. I was very much amused at the occurrence, as I felt satisfied that mine was all right, having watched it during every change from Madrid to this place. When the little struggle took place for the baggage, I heroically withstood several fierce attacks on my little valise and carpet bag. Not being able to find an owner for the package, it was laid down, and there took place—a stand-still.

We walked up and down an hour waiting for something to turn up. All this time the mules were hitched to the diligence upon which was the luggage; but, to our astonishment, no order was given us to mount. At last the cold atmosphere had its effect upon the brains of the passengers, who became uneasy, and they began questioning each other as to the reason for not starting. As no one could answer, impatience soon turned to anger, and one person stepped up to the conductor, who was musingly leaning against a pillar, and asked him for an explanation. He answered that it was on account of this package, for which he was responsible; he was certain it belonged to some one in the diligence, and he could not take it out of the dépôt until some one claimed it; then, again, if he left it behind, the company were responsible for it to the owner, and he did not wish to get himself into trouble. His answer was cool and philosophical. It was in vain the passengers grew angry; his calmness did not desert him.

So matters stood when the passengers gathered together again, and consulted vehemently on the subject. At last, when their indignation was fully aroused, they determined to go to a fellow-passenger who was a *Delegado*, and rouse his energy to action. This important person was calmly seated on a sofa, wrapped up in a warm cloak, thinking of his greatness, or, perhaps, whether Mexico should or should not be again annexed to Spain. In his dream of great things he had altogether forgotten little ones, and

had not even noticed our delay—thanks to his comfortable coat. The passengers delegated him to represent them to the conductor. The *Delegado* was so much taken by the gravity and importance of the position, that he walked up to the conductor and demanded an immediate start. The demand was followed by the desired effect. A consultation was opened, and thus concluded: "Since every passenger present apparently had his baggage, and since every passenger in the diligence denied being the possessor of the package in question, it was decided that the named package did not belong to any of the passengers; therefore, if left, the company would not be responsible for it."

This decision was received with applause, and soon we were galloping away. This delay, caused by these disputes, occupied two and a half hours. Of course, myself and son, being the only foreigners in the diligence, kept quiet. One reason for our not interfering was the fact that we were Americans, who are held in great dislike in this country. Even the deputy's face beamed with smiles when we at last started.

We had made but a few hundred yards when we were stopped and counted head by head. Yankee-like, I stuck my head out of the window to see what now was in the wind. I saw the conductor, driver, postillion, and an aid gathered around the door of a house, disputing violently. In the door were two men—one a gendarme, with his carbine; the other with a paper in his hand. The latter said, firmly, that we could not be allowed to proceed, as we had one more person in the diligence than the law allows. All wanted to speak at a time, so that a confusion ensued in which none understood what the other said. Finally, the conductor succeeded in "getting the floor" alone. He remonstrated, saying that the person who was too much was a young child sitting on his mother's lap, and could not be separated from her; besides this, as she had her husband, it would be cruel to separate them from one another. Notwithstanding this eloquent appeal to humanity, the man with the paper remained inflexible. Nothing could move him, until one passenger, far away from the boy, declared that the child was very small, did not occupy any place, since he was on his mother's lap, and that he was not at all troublesome. At this declaration, and its unanimity (namely, one man), the official yielded, and we went on.

However, doubts soon arose in my mind whether the person who so generously pleaded the cause of the boy had not better

change seats with me, at least for a time. The little fellow went to sleep leaning his head and whole body on me. Now, as the road was not over smooth, the diligence sometimes gave a jerk on one side, sometimes on the other, and the child followed its movements. Imagine what a pleasant position I was in. I would much rather have been on a "grizzly" hunt. Three nights previous I had not slept. However, I consoled myself with the idea that all my pains would be remunerated by a sweet smile from the daughter of "a hundred dons of old renown" when daylight came. I awaited daylight with impatience. At last it came, and I found the *señora* of my dreams not very ugly, not very old, but very dirty.

Near seven o'clock the conductor announced to us that we were to breakfast in the village which we were then entering. No sooner had our feet touched the ground than we were surrounded by about thirty beggars. They really besieged us. Resistance was out of the question. In the first place, it would not look well to attack a lot of old men and women, all blind, lame, or diseased; then they were in greater number than we. I was struck by an idea: putting my hand in my pockets, I pulled out a handful of copper coin and threw it among the crowd. The move was most successful; there was a general scramble, in which the lame walked and the blind saw. While they were still scrambling for the money, we gained the inn by the road which they had left open to us. Once in the tavern, we were safe, unless we approached the door, when they began making a piteous noise, begging in the most moving language. This invariably happened whenever we approached the door, and we as invariably made a hasty and disorderly retreat to the interior.

A couple of miles on the other side of Balde Pengas the vine plantations begin again. The soil is either of sand or clay, or a mixture of the two. The wine is fermented in large clay jars from six to eight, or even ten feet high. The wine has a peculiar and disagreeable taste, which makes it almost impossible to drink it after it has once come in contact with the palate. This comes from the hides which the wine is put in. They have no barrels. Every ordinary wine that I have yet drank in Spain has in it either aguardiente or alcohol; this renders them unfit for common use, for they naturally are very strong already.

The fifteen minutes allowed for breakfast over, we huddled in again to our places. The little boy, being tired of sitting on his

mother's lap, took half of his mother's seat and half of mine, which was already not too large before. However, I managed to squeeze myself some way. The heat was intense, and the dust intolerable, for it was as fine as it was penetrating. Away we went, followed by four or five little girls and boys, who ran alongside of the diligence begging. The girls gave up in about three fourths of a mile; the boys held out longer, and one of them ran for at least four miles. We had thrown out to them some coppers from time to time. Neither the girls nor boys wore shoes.

Our way led us near to the railway which was being built; we saw hundreds of men and women working on it. They all of them had on their backs a basket hardly holding four to five gallons; they would creep snail-like to where the dirt was found, fifteen to twenty yards off, leisurely fill the basket, and then return in a manner so slow that the slowest man in America would become desperate. When they arrived at the place where the load was to be deposited, they threw it down, but always in the most careful manner. These railway contractors seem not to have the least practical idea; had they one, they would have all this transportation done by machinery. We passed several other places where they were also working, but all in the same snail-like way.

The mountains are all barren; not a tree can be seen. Now and then we passed a miserable village filled with beggars. You can not walk, stand, or sit any where without being besieged by them. It is the most annoying thing that can be imagined; they will not be contented with a simple refusal, but will obstinately follow you up wherever you go.

We at last reached the top of the mountain, where we found a table-land. It was here that we saw the ancient Moorish town of Carolina. It is a thriving village, and surrounded, as far as the eye can reach, by olive-trees; these furnish a most pleasing contrast with the barren country through which we had passed since we left Bayonne.

We were several hours passing through this really beautiful country, when we arrived at the place where we were to dine. Victoria, I believe, was the name of the place. I succeeded, in spite of their numbers, in making my way through the beggars, and coming to the kitchen. I seized upon the first thing which fell under my hands and looked like a wash-bowl. After washing my face, I was lucky enough to find a clean corner to wipe it. Our dinner was a Spanish one. What was wanting in dishes

was made up in charges. The conductor did not leave us much time to dispute the charges, but hustled us into the diligence, and away we went. Our road still led us through many beautiful olive and vine plantations. The boy settled the right to the seat by taking up the largest half of it. Night soon set in and veiled the scenery from our view. As darkness came on, the boy returned to his mother's lap, to my great relief, for when he went to sleep I only had to support half of him. Arrived at Jean, several passengers left us, and the lady with her little boy went into the Rotonde. Her place was taken by a gentleman, and from here we enjoyed a little more comfort.

We entered Granada at ten o'clock in the morning. It is an old Moorish town, has quite a considerable population, and, from what I could see, was quite thriving. Its produce is olives, oil, wine, hemp, and lead. This latter article is found in quite large quantities in the neighborhood. The hotels are miserable, and their prices exorbitant, as myself and fellow-passengers can all testify.

September 24.—We were informed that the stage would only leave at seven in the evening, so we would have time to see every thing. I went to a hotel, engaged a guide, and ordered him to get me saddle-horses to see the celebrated Alhambra. He soon returned, informing me that he could not get saddle-horses, but that he had engaged a carriage for three dollars. Informing me that the stable where the carriage was lay on the way to the Alhambra, I thought that we might walk to it. He advised me to do so, saying that it would save time. This phrase "save time" sounded pleasantly in my ear, for it was so long since I had last heard it. It did not astonish me, for our guide, who was a young Spaniard, had lived some time in America.

What was our astonishment and indignation on seeing our carriage, which was no more or less than a very old two-wheeled Spanish cart, without springs. It had two boards on the inside for seats, with rags for cushions, held up on the sides by ropes. After some grumbling we got in. The concern was drawn by a large bony mule, led by the driver, who walked alongside, and occasionally gave him a poke in the ribs with the butt of his whip, which had a nail in its end. As we rode in the streets we looked out to see if any one was looking at us, but no one paid any attention to our "carriage," so we came to the conclusion that it was the customary mode of traveling here.

We continued our way slowly through the narrow, winding streets until we came to the garden gates. In due time we arrived at the Generalife. It was here that we perceived how finely our guide had taken us in. In the first place, the walk through the streets would have been much more agreeable than the horrible shaking and jolting of our cart; secondly, the distance was very short; and, lastly, the walk would have been a most agreeable one through all the beautiful and shady alleys.

I will not attempt a description of this beautiful palace, which is considered the finest the world ever had. For that I refer my readers to Washington Irving. Only he has done justice to the beautiful palace, magnificent view, gardens, and legends. Read his "Legends of the Alhambra," and you will be here.

When I had sufficiently admired the scenery and all the beauties of the palace, I started down on foot, not caring to rub off the small part of skin still remaining on my shins. My son, however, thought to make the most of a bad thing, and so went in the carriage to the Cartuja, celebrated for its interior architectural beauty, and the mad-house, which was an ancient convent, built by Ferdinand and Isabella, in accordance with a vow which they had made to that effect while reducing Granada.

I inspected several manufactories, but none of them had any thing worth mentioning to my readers. I returned home and wrote up my journal.

I found much difficulty in reaching home on account of the beggars, who were not only in great numbers, but also very impertinent. They would cry out, "For God's sake, look at me, sir; I am old, sick, and in want." In looking at them I was often astonished how they could use such terms when they looked so well, and were neither old nor badly dressed. It seems to have passed into a habit with Spanish people. I really think that one third are beggars. Some Spanish gentlemen informed me that it was not considered as derogating from one's dignity to beg.

We left Granada in full speed at seven o'clock, and almost ran down a dozen soldiers who were drilling. They were marching in double file toward the road. The conductor thought that they would halt, and the captain thought that the diligence would stop, and so both continued, until the men, seeing their danger, broke the ranks and fell back, no doubt thinking that they would be safer farther off than under the wheels. What the captain thought I don't know. The conductor did not stop to ask his opinion on the subject.

Our seats were pretty comfortable, they having placed us into the Berline, as they call it here. We tried in Madrid to get the same seats which we had in coming from Bayonne, but they had already been taken.

I could not judge of the appearance of the country, as it was dark and cloudy. When daybreak came we were on high mountains, planted from the valleys to their very tops with grape-vines. The soil is red and rocky. The appearance of the country was very picturesque, as on the tops of the mountains, on their sides and in the ravines, houses were built. This was the first time I witnessed in Spain an idea of practical life. This is certainly far better than huddling themselves together in dirty little villages. Not only is it more healthy, more comfortable, but it is also more profitable.

The mountains are very steep, so the cultivation must be done by hoes; the work, however, is not overdone. It does not rain for seven or eight months during the year, consequently but little grass grows. Even if it did rain, the weeds would not come up very fast in such poor ground.

The wine of the mountains has the taste and look of dark sherry, and, if care was taken in making it, it would become an excellent wine. The people here seem to make no improvement whatever; their wine is still made in the same manner that the Romans employed when masters of the country.

Our road still wound up the hill for some time, and vineyards were planted from the foot to the top of the mountains. Arriving at last on the top of the mountain, we had a magnificent view of Malaga and its fertile valley. The prospect was beautiful, and for a moment I forgot all my road troubles in looking on the scene which lay before me. All was smiling to me; the large plantations of olive-trees, vines, oranges, and lemons; Malaga with its manufactories; the old Moorish citadel and its cathedral—all present a most pleasing view, which called out admiration when from the town you turned your eyes toward the sea, sprinkled here and there with white sails. My pleasure in beholding this scene was not a little enhanced by the thought that at last my traveling by diligence would end.

Descending the mountain, we passed several raisin-making establishments. They are very numerous around Malaga.

We soon reached the city, and proceeded to the Alameda Hotel, which proved to be an excellent one. After having well

washed ourselves and breakfasted, we were but too glad to lie down and take a sleep of several hours. We needed it after the six or seven days or nights that we had passed in the diligence.

When our dinner was taken we went to the Alameda, or promenade, where there was to be music. Here we saw all the fashionable people promenading up and down, among whom were many dark-eyed señoritas. After listening for some time to the music, which was very good, I returned to the hotel to write, and my son Arpad went to the theatre.

September 27.—In the morning we hired three horses, two for ourselves and one for our guide. Our steeds proved to be fine ones of the Andalusian race. We first proceeded to the dwelling of a nurseryman, but, not finding him at home, we went to the vine plantation of Don Luis Arra de Breka. This vineyard is 200 *fanegas* in extent. It makes 5000 boxes of raisins, 15,000 *arobas* of Malaga wine, and 300 *arobas* of vinegar. A box of raisins weighs twenty-five American pounds, and a barrel one hundred pounds. An aroba contains twenty-two bottles of wine, and a fanega of land contains fifteen hundred vines. These statistics were furnished by the overseer, who readily gave us all the information we desired. The establishment employs sixty men in selecting, drying, and packing the raisins.

The drying-grounds consist of an elevation whose surface makes an inclination of forty-five degrees, whose length is sixty feet, and width twelve. It is built out of brick when a natural elevation can not be found. The drying-grounds are separated from each other by bricks stuck into the ground. These bricks are about eighteen inches long, one and a half inches thick, and six wide. The floor is a clay soil, overspread naturally or artificially with small loose pebbles. It resembles somewhat a threshing-floor, only is not so hard. The grapes, when ripe, are brought and placed on these drying-grounds, which are invariably built facing the noon sun, that they may receive the greatest possible heat. It is to obtain this effect that these grounds are inclined forty-five degrees, for it is at this inclination that the heat is the greatest.

The grapes, laid simply on the ground as above mentioned, will naturally become dusty, or have some particles of dust; therefore I asked why they did not spread them on a canvas or on straw mats. The answer I received was, that neither canvas nor straw received as much heat as the ground, and, consequently, the latter would dry the grapes much quicker than the former. With all

this, I believe that many improvements might be made in their manner of making raisins. Asphaltum, well mixed with sand, being black, would receive a very great amount of heat from the sun.

The drying-grounds are every evening covered over with boards, one overlaying the other, so that no rain or dew may reach the grapes during the process of drying. The grapes are left on the grounds eight, ten, and twelve days, according to the weather and their progress in curing. But, inasmuch as the size and ripeness of the grape comes in for a large part, they do not dry all at once; and so, when the attendant sees some which are ready, three or four men are put to work at the lower ends, to pick out those which are cured, gradually proceeding upward. They are seated on a plank resting on the separating bricks, and have on their laps small boxes which hold about eight pounds of raisins. These raisins are afterward taken into the adjoining pack-house, where a person with a pair of scissors cuts out all the rotten or inferior grapes. It is then passed to the *Selector*, who selects all the fine large grapes, and puts them in a box beside him, of the same dimensions as the former. The other raisins are left in their own box, and filled up afterward from the second quality of succeeding boxes. The first class is passed, when the box is full, to the weigher, who fills up what is wanting, and takes out what is too much; each must hold exactly six and a quarter pounds of raisins. It then goes to the *packer*, who upsets the raisins into a box of the same dimensions lined with paper; afterward he puts them in a transporting box, which contains four such small ones, and weighs twenty-five pounds. Each six and a quarter pounds is separated from the other by the above-named paper. If the paper is taken by the corners, the raisins may be taken out six and a quarter pounds by six and a quarter pounds without disturbing them or their order. In fine large raisins these four layers of paper are absolutely necessary to each twenty-five pounds, as they absorb the must of the grapes, which, to preserve their size, have not been completely dried, as that would shrink them up considerably. The second quality is treated in the same manner in every respect as the first. The only difference between them is their size.

The berries which were cut out by the scissors are all thrown into a barrel, and then taken to the press-house; there they are trodden by men with shoes; then the pressed juice runs from the

press into a large vat-like hole, made out of bricks and plastered with Roman cement. It is dipped out from here with buckets like water from a well, the juice being almost as thick as tar. Then it is taken to large vats or barrels. In large establishments the barrels or vats are made of oak, but in smaller establishments there are large earthen jars holding from ten to two hundred and fifty gallons.

When the juice is poured into these jars or tanks, to each ten gallons of juice one gallon of aguardiente or brandy is put. It is then left to ferment slowly, no more care being taken of it for six months, when it is drawn into a new barrel. As is well known, the Malaga wine requires six to eight years to make it good and marketable. It is very heavy, and extremely sweet. Not much is used by Americans; England and Russia consume the most of it.

The residue—skins, stems, seeds, etc.—after being thoroughly pressed, is put into a large cemented vat; a large quantity of water is thrown on, washing it thoroughly. This artificial juice is let run down into a well made of bricks and cement, where it is left to form itself into vinegar, and, when ready, it is drawn off and sent to market.

Besides the above-described drying-plots of forty-five degrees, there are here also twenty to thirty drying-plots which are almost level. The floor is similar to the ones described. The width is, however, twenty-five feet, and, instead of being covered in the night or rainy days with boards, a canvas is used, so arranged that it can be brought on or off the ground by drawing a cover across a pole. This seems to be the better method, as much labor is required to lift the boards, which must be done by two men, and piece by piece.

There are two drying-places in the vineyard and two packing-houses, to one of which is attached the wine-house and press. There are no cellars, the wine being kept in a large room in a stone house.

In the same place are raised and dried fifteen to twenty thousand pounds of figs, which are dried in the same manner and upon plots as the grapes; only instead of being lightly pressed into the bags and boxes, they are solidly pressed; for the more they are pressed, the more saccharine they become. Figs require ten to fifteen days in curing. The pressure must be just heavy enough to flatten the figs without smashing them. The fig-trees

are planted promiscuously, whereas the almond-trees, of which many are raised, are planted in avenues.

The vines are planted two *varras* apart. They are kept low to the ground, and are trimmed to one size. According to the thickness and strength of the vine, it has four to eight shoots. The vine is pruned every year to one eye, and forms a kind of knob or head. The shoots are not staked, but left to run on the ground. After the month of June the ground is gathered up around the vine as we hill potatoes. This is done to permit the sun to fall on the roots and draw the heat to the grapes. The vines are thrifty, and the soil is red and gravelly.

We arrived at a packing-house; the servant took our horses and tied them separately. As I was taking notes I heard a terrible stampede. Running out to see the cause, I found that one of the horses had pulled off the bridle and "pitched into" the one standing next him. The third one, also wishing to have a hand in the matter, broke his bridle, and the fight went on lustily. The third, being somewhat inferior, soon gave up, after receiving several kicks and bites, but the others fought like tigers. We tried to stop the fight, but no whip, stone, or pole could separate the combatants. A score or more of men surrounded them, but in vain. One of the men threw a stone at one of the horses, but it missed its mark, and landed in the stomach of my son, almost knocking him down. At last they were separated; but what a sight! They were bleeding every where, and the bridles and saddles were all in pieces. I contemplated the scene before me, and the figure of my landlord rose up before my vision like the ghost in Hamlet. I saw in imagination a long paper with a fearful column of figures, the sum total at the bottom being quite too long to be read.

After patching up our bridles and saddles, we remounted for the city. I was hungry, having started without breakfast, but my appetite was considerably decreased by the vision of the coming bill. At last we arrived, and rode to the stable. I watched my man. He looked at his horses, shook his head, told me he must send for a veterinary surgeon, etc. This calmness foreboded no good. It showed diplomacy, which I determined to meet with the same. I went to our consul, Mr. Hancock, an excellent gentleman, by the way. I told him my suspicions about breakers ahead. The consul immediately sent his clerk to the Civil Register's office to have our names registered; this would make the

matter more complicated for the stable-man to get an exorbitant judgment for damages. So the matter rests; and so I must retire without knowing how far my pocket will be drained.

September 28.—At seven we started again with the same Andalusian steeds, who were oiled, and the bridles patched up. The owner and I exchanged no words. After riding five miles we arrived at the residence of General Concha, the military governor of Granada. On this property there are many olive-trees, also an olive-mill, which is very simple, consisting of a round stone basin with a conic stone in the middle, which is pulled by a horse or mule. The stone crushes the olives; the olives are then put into a screw-press. By this means the oil is extracted and runs into the stone basin, and from there through a trough into a barrel. The Spaniards do not refine their oil like the French or Italians, and it sells for less, though it is really finer. It is used with all the sediment. This makes it disagreeable in cooked dishes. Sixty olive-trees are planted on one fanega of land; grain or vines are raised between. The olive-trees, being planted near to the sea, do not do so well as in the district of Cordova, where the average production is twenty-five pounds of oil to the tree. Here not more than half as much is yielded. One aroba of oil is sold for fifty-eight to sixty reals—about three dollars.

On our road we passed a cotton manufactory, where cloth is made by a New Orleans company. We saw an iron or smelting establishment, also owned by foreigners, but of what nation I did not learn. To the right and left of the road there is a great deal of sugar-cane, which is ground by a mill in Malaga.

After examining the trees and the olive gathering, which is now beginning, we returned to the city, having engaged from a nursery-man in the office and presence of our consul several thousand of raisin-vines, olive, pomegranate, pepper, orange, fig, lemon, and other trees. I visited several prominent merchants, to whom I was introduced by Mr. Hancock.

As I was leaving my hotel I saw a herd of goats. Their owner was hallooing "*Leche! Leche!*" loud enough to wake the dead. As he was screaming, people ran from the houses with pails. These he took, set down by the goats, and milked the pail full, received his money, and satisfied his customers. This is a certain way of getting unadulterated milk. This was not entirely new to me, as I saw it tried by a Frenchman with cows in San Fran-

cisco, but he gave up the business on account of having no customers.

After a good dinner with the consul we made our arrangements for departure to-morrow by the steamer for Alicante. I found that no steamer goes to Portugal, as they would have to stay in quarantine, as the yellow fever has broken out in the south of France. I was disappointed, as I intended to visit Oporto; but then the vine disease is universal, and I may have introduced it into our state.

September 29.—After paying our bills, which were very high, we started for the steamer. Mr. Hancock accompanied us, but before sent his clerk, Don Luis, to the police-office and French consul, to have our passports go through all the annoying formalities; but, as Don Luis had no breakfast, and not finding the consul at home, he gave the passports to the porter. He returned in a short time, and found that the porter had taken a trip in the country, taking the passports with him. This annoyed Don Luis; but, like a prudent general, he made out two others, had them viséd, and came down just in time for the consul to sign them. Mr. Hancock "blew up" Don Luis for leaving the passports, bade us adieu, and we jumped into the boat just in time. The many attentions I have received from Mr. Hancock will ever keep him in my remembrance.

I may here mention that all the harbors in the south, as Genoa, Marseilles, Malaga, etc., have no wharf, but you are obliged to embark in small boats. This makes it very inconvenient, particularly for ladies. The shipping is very close together, and in passing along one is often inundated with slop-water. It is really astonishing how little progress these people are making. We started at twelve o'clock precisely in an iron steamer, the *Paris*. We kept close to the shore, passing the fertile valley of Malaga, and sailed by her high mountains, all covered with vines and villas. Soon, however, steep, rocky, barren mountains took the place of the beautiful fertile valleys. Night set in, and with it a furious wind, which kept increasing so much that nearly all the passengers were sea-sick, and the steamer was delayed full ten hours, arriving at Alicante at eleven o'clock at night.

October 1.—The steamer remaining two days, it gave me an opportunity of examining the neighborhood, and engaging such vines and trees as the country possesses. First I went to the market, where I found some grapes which I do not yet possess.

From there I presented myself to the American consul, Mr. Leach, and made arrangements with him to send to Havre the vines I had purchased. After visiting the neighborhood, which is not very inviting, we returned to the steamer, which lay anchored in the harbor.

October 2.—This morning was fine and clear. At nine o'clock the cargo arrived, and was speedily hoisted into the steamer, which then left. We passed several valleys planted with olives, figs, vines, etc. They all looked very well, but the valleys are few, and there are numerous high, barren, rocky mountains.

October 3.—This morning opened calm and pleasant, but we were out of sight of land. As we neared shore, we met thousands of fishing-boats, with "shoulder of mutton" sails. The fishing trade is extensively carried on at Barcelona, Alicante, and other villages on this coast. The fish are caught in large quantities, and packed in olive oil. The coast is well populated. Numerous villages are scattered over the hills and valleys. Figs and olives are the principal produce. This part of Spain—Catalonia—is the richest in produce and manufactures; the people are more industrious.

We arrived at Barcelona at twelve o'clock. The steamer remaining four hours, we took a small boat and landed. The city is a busy commercial town. The shops are fine; the goods come from all countries; but the streets are narrow, as in all towns of Southern Europe. It has several fine public buildings, monuments, promenades, and squares. The population was stated to me at 160,000, but I doubt the number. There are large and numerous manufactories here of cotton, iron cutlery, woolen, etc. The harbor is full of vessels; the wharf full of grain, peas, corn, oats, fruit of all descriptions. The grain is put loose in the ship-holds, and when it is to be moved it is put into bags, taken ashore, emptied into a pile, then again put in bags to be taken away. This is a very awkward way of doing business, particularly as there are linen manufactories, and linen is cheap. The sardine fishery is in full operation now, and the packing requires a great number of men.

I made some inquiry as to the making of the wine, which is not agreeable to drink; but a great deal is taken to Brazil, England, and even North America. Many varieties of grapes are mixed together, crushed with the feet, put into a vat; a good portion of lime is added, with which it ferments. The lime gives it a dark-

er color. The whole is fermented in a vat built of stone and cemented. The fermentation lasts from two to four days; is very strong, as the lime aids it. When the fermentation stops, the whole is drawn off and put into barrels, and often leather bags made of hogs' or calves' skins. At the same time, one third or one quarter of alcohol is added. The wine is used the same year, but when alcohol is plenty it will keep for any length of time. The same process is used in all the vineyards.

At five o'clock we left for Marseilles. The weather was fine. We arrived October 4th. At ten o'clock we took the train for Paris. Being night, I could see nothing. In the morning, however, we stopped at Lyons, the great silk manufactory of France. The adjoining country is well cultivated. The people were busy sowing wheat. The grain-lands extend to Villafranca, then vines begin to predominate. Around Macon are planted all vines.

Tours and Chalons have partly vine and partly grain planted. From Chalons to Dijon the whole country is planted with vines. But I have already given a description of this country.

October 5.—Having arrived in Paris, I found letters awaiting me there which demanded my immediate return home. Having visited all the prominent wine-growing countries except Hungary, my return was at once resolved upon. It is true that my original intention was to visit Greece and Egypt; but, finding that the plague had broken out in Syria, and I would have to remain in quarantine for forty days, even if I escaped the sickness, I, of course, decided not to go. Even if I had gone, I could have thus done no service to the State, as the wine-making is still carried on in those countries according to the old plan. The vines and cuttings I procured through the American consuls.

My determination to speed home was farther strengthened by the fact that the Legislature would meet in the beginning of January, and would very likely be in session but a short time; and, as I was required by the joint resolution to report before this body, my preparations were soon made.

Ootober 14.—I went to Havre to make the necessary arrangements there to receive the vines from all parts as already stated. The vines were all to be directed to the American consul. Having made the arrangement with the consul and Messrs. William Isilin & Co., we returned to Paris the next day, packed up our traps, bade good-by to our new acquaintances, parted with our family, whom we left behind partly because a stormy passage was

expected, and partly on account of my son, who is studying practically the manufacture of Champagne in Europe, and has been so engaged for the last year and a half, and whose apprenticeship will be out in the spring.

On our arrival we gave our attention to the drainage of lands. Went to London, thence to Liverpool. There we embarked on the English steamer Europa. After a stormy voyage of fifteen days, arrived in Boston; from thence to New York, and finally arrived in California December 5th.

CHAPTER IX.

GRAPES AND WINES IN CALIFORNIA.

The Author's Experience.—Climate.—Site.—Soil.—Plowing.—Laying out a Vineyard.—Digging Holes.—Planting.—Cultivating.—Pruning in different Years.—Summer Pruning.—Crushing.—Cost of Planting a Vineyard.—The Author's Expenditure on One hundred Acres.—Quality of the Author's Wines.—Mr. Szemere's Pamphlet.—Adulteration of Wine in Europe.—Quantity of Wine produced in France.—The Wines of Hungary.—Prospects of Wine Culture in California.—Statistics of Wine Culture in Europe. — Good and bad Years in Europe. — The Advantages of California as a Wine Country.

Having given the mode of planting and treating vineyards in different parts of Europe, we deem it necessary to say something of the mode of planting and treating vineyards in California.

It will be apparent to practical men, who have cultivated vines in this country, that for us to practice many of the systems in use in Europe would be unprofitable, either on account of the difference in climate, or the high price of labor in California. On this head, however, we do not anticipate any difficulty to our intelligent and reflecting planters, for they will soon determine which mode of cultivation is best adapted to our soil, climate, and price of labor. But, for a guide to beginners, we will give a few extracts from an essay written by the author for the State Agricultural Society in 1858. It should be remarked, however, that a farther experience of four years proves that some of the instructions laid down in this essay require modification. We have arrived at this conclusion by careful observation of our own, having a vineyard of some four hundred acres, which, to the best of our belief, is the largest in the United States. We frankly confess that the result of careful experiments, made on similar soils, has changed some of our opinions, and our error was clearly proved by observations on our late European tour. We hold that confessing an opinion formed to have been erroneous is not only proper, but a duty we owe to science.

Whenever, in the extract from the essay, a difference of opinion between what we then held and what we have since formed

occurs, we will note it, giving our *present* experience on the subject.

Climate.—The California climate, with the exception of the seacoast, especially where the prevailing western winds drive the fogs over the locality, is eminently adapted for the culture of grape-vines, and it is proved conclusively that no European locality can equal within two hundred per cent. its productiveness. The oldest inhabitants have no recollection of a failure in the crops of grapes. The production is fabulous; and there is no doubt in my mind that before long there will be localities discovered which will furnish as noble wines as Hungary, Spain, France, or Germany ever have produced. Vineyards planted in various counties, beginning at San Diego up to Shasta, have given magnificent results, and leave no doubt in the mind that the north is as favorable and productive as the south.

Site.—In California site is not so material as in European countries, especially where, during the summer season, a good deal of rain falls; and if the vineyard is not exposed during the whole day to the sun, the rain will rot and damage the grapes. California, having an even temperature, is warm and without rains in summer. Almost any locality will do; but if a western gentle slope can be obtained, by all means it should be taken.

Soil.—When the planter resolves to plant a vineyard, he should determine whether he is planting to produce grapes for wine or for market. If for the former, he must look for a soil which is made by volcanic eruptions, containing red clay and soft rocks, which will decay by exposure to the air. The more magnesia, lime, or chalk the soil contains, so much the better. This kind of soil never cracks, and retains the moisture during the summer admirably. Such a soil will produce a wine that will keep good for fifty or one hundred years, and improve annually; is not liable to get sour, or, when exposed to the air after one year old, to get turbid, and change color in the bottle or glass.

If such soil can not be found on the ground desired to be laid out for a vineyard, the second best may be taken, which is a shell-mound. There are many localities in this State, even as high as the mountain tops, where acres of land consist of decayed shells. Such soil will give a good wine in great abundance. The next best to the above soil is a gravelly clay, slightly mixed with sand, so that it will not crack. If it can be, red color or dark black;

but avoid gray clay, which bakes in summer. The last of all which may be used for the production of wine is a light sandy, gravelly soil. This will give an abundance of wine, but it will not keep for any length of time. It will soon change color and become sour when exposed to the air; and the only mode of keeping this kind of wine for years is by adding to it brandy or alcohol, which, of course, deprives it of its purity, and makes it injurious to the health of the consumer.

The soils described above are recommended for producing wine, as just stated; but for producing marketable table grapes, the planter should select a piece of ground which is a rich black gravelly or sandy loam, exceedingly mellow, as most of the alluvials are; and if well-rotten manure from sheep or cattle corrals can be obtained, it will pay well to haul it on the ground. To be prepared for the grape-vines, it should be moderately moist, though not too moist. In this State deserted Indian villages are often found. In such localities the soil is exceedingly rich. A bucketful of it in the hole of a vine will astonish the planter by its effect. Such soil as just now described, either made by nature or artificially, will produce magnificent bunches of grapes, with large berries, in an immense quantity, which, of course, will please the eye and palate, as the bulb or skin is thin, and consequently the best qualified for table use.

Plowing.—The best mode to plow the land is with the so-called "deep-tiller;" for with it, by putting three horses abreast, you can plow twelve inches deep, except the soil should be very rocky. Follow this plow, in the same furrow, with a common shovel-plow, or, as it is called in some places, bull-tongue. This simple instrument, with two horses attached to it, will tear up and pulverize the earth ten or twelve inches more in depth. There are various designs of subsoil plows, but most of them require a great moving power, and will not answer after all. The above-named "bull-tongue" is successfully used by many planters in Sonoma and Nape Valleys. But it matters very little what plows or subsoilers the planter uses, as long as he plows and subsoils his land from twenty to twenty-four inches.

Laying out the Vineyard.—It is sufficiently proved, by close observations in Europe and California, that the vine planted eight feet apart is the best mode, especially in California, where land is yet cheap and labor high. Vines planted at this distance can be worked with the shovel-plow and one horse. Eight feet is as

close as persons ought to plant. If planted closer, the vines, when five or six years old, will branch out considerably, and in the months of May, June, and July, all the tender vines would be broken by using a horse and shovel-plow. The planter would be therefore compelled to employ hands with hoes, and this would cost, in the first instance, ten times as much as horse-power; and, secondly, it would not do as good work, for no man will hoe as deep as a shovel-plow goes. Persons laying out vineyards must not be miserly, but leave wide roads—say twelve feet; at least one road every fifteen rows, which would be one hundred and twenty feet apart. Otherwise, when the vines bear and the grapes are picked, the person picking them must carry a heavy basket a long distance, to the road where the cart stands to haul it to the press-house. In reality, no person will lose any thing in the crops on account of the road, for the rows adjoining each side of the road will bear more, as they have an additional four feet of ground to feed on. No planter should, under any circumstances, plant trees of any description in a vineyard. A vineyard must be a vineyard, and nothing else. I need not waste room here to direct how to lay out the rows. Every man knows that, and has his own mode for it; but a straight row in every direction is essential to a prosperous cultivation.

Digging Holes.—When the land is laid out as above recommended, and a stick staked at every point where a vine is to be planted, a hole must be dug twenty inches square, and about two feet deep. The ground from the hole is to be laid out as follows: the top ground to your right, the second ground to your left, and the third in front of the hole. Then the bottom of the hole should be well dug up with the spade, leaving the last ground in the hole. The earlier the holes are thus finished before planting, the better; then, the longer the earth is exposed to the atmosphere, the more it will be fertilized. Before you begin to plant your vines, have the holes filled—for rooted vines to about six inches from the top, if for cuttings about ten inches.

[In regard to the distance between vines, we would observe that, for California, our opinion in regard to the space of eight feet has not changed; but we have some hesitation in expressing a recommendation for the same distance after having seen the fine Burgundy Pineau and the world-renowned Riesling planted so closely. Whether these grapes will give the same generous wine, with that exquisite bouquet, if planted eight feet apart,

remains to be proved by experiments. Our doubt originates from the generally established facts that, when vines are pruned for *quantity*, the *quality* will suffer. This fact is proved by scientific observation. The question which arises in our mind is, whether vines planted eight feet apart, producing eight pounds of grapes, pruned to the very minimum of the Californian yield, or whether sixteen vines, planted on eight feet of ground, producing one fourth of a pound of grapes to each vine, would make a better wine. It is true that one vine has, in the first case, as much soil to live on as sixteen vines in the other, but whether the sixteen vines do not possess more roots, leaves, and power to extract from the atmosphere more congenial elements for the development of that fine quality and bouquet they should have, is a question which we are not prepared at this time to answer. It is our intention to make experiments on this subject in future, and it would be well if other planters in different localities would do the same.]

The ground to your right, being the top ground, is thrown into the bottom of the hole, then that to your left. This done, you proceed to

Planting.—There are two ways of planting—one with cuttings, and the other with one-year-old vines. There is a good deal of difference of opinion among good and practical vine-planters. Some argue that if a cutting is properly planted at once on the spot of its destination, it will be more advanced in its third year, and, consequently, it will bear in that year more than the rooted vine, which is first set as a cutting in the nursery, and the next year transplanted on its destined spot. It is reasonable to suppose this to be the case; but it still leaves a doubt in the mind whether a large tract of land can be, or will be, as well worked as a small one. In a nursery, by good care, the cuttings can be rooted four times as strong as in a large field; besides, in the latter case, whether the vine has good roots or not, it is left where first planted; but when the rooted vines are taken out of the nursery for transplanting, the planter will select only those having faultless roots. But the greatest advantage of the nursery is, in my opinion, the fact that if a planter intends to plant one hundred acres of vineyard with cuttings, he will have to cultivate one hundred acres during the summer; but if he plants his cuttings for this one hundred acres in a nursery, two acres of ground will be enough to raise sixty-eight thousand rooted vines, the number required for one hundred acres. Now, to cultivate these two acres in the nursery, it will require ten days' labor with one horse;

" Vines planted 8 x 8 = 680 to acre

while, on the contrary, for one hundred acres, during the months of March, April, May, June, and July (after that time no more plowing is required), you need two men and four horses—equal to two hundred and sixty days' work, and double that for the teams. Then the board of the men, and feed for the horses during that period. However, this is a matter of opinion, and each planter will follow his own idea, or will accommodate himself to surrounding circumstances. But now to the planting.

When the holes are filled as above described, if you plant cuttings, have them two feet long; bend the cuttings ten inches deep in the hole, near to a right angle, the lower part of which is laid horizontally on the bottom, and the upper part on the side wall of your hole, the top of it to be above the ground three inches. Then fill the hole from the ground surrounding the hole, which, of course, is top ground: then tramp the earth fast on your cutting, that no vacancy shall remain in the hole. Otherwise foul air will gather in said vacancy, and the cutting become mouldy, and will not live. But if you plant rooted vines, your holes will be filled to six inches. Now take your rooted vine, spread the roots on the bottom, and throw from the surrounding top ground on the roots; shake it well, so that the pulverized ground shall get among the roots. Then tread gently with your foot round the root. It is still better if you prepare, from one part of fresh cow manure and three parts of black earth with water, a mud mixture of the consistency of tar. Put, before planting, your rooted vines in the same, and when so dipped, turn them in the bucket round and round. By this every root and fibre of the vines will be surrounded with this tar-like stuff, and prevent it from becoming mouldy under ground. After this, the ground in the front of the hole, taken out the last of the same, is to be leveled about the vine so as to leave a dish-like excavation around, as a receptacle and conductor of moisture to the roots. Be careful never to plant your vines too deep. It is better—if you make a mistake—to have them too shallow than too deep.

Cultivating.—The vines having been planted—either as cuttings or as rooted vines—in the month of January, the ground being recently plowed, not many weeds will be visible before the month of March. But this month it will be time to commence, either on account of weeds, or that the ground has already hardened around the vines, and requires stirring and pulverizing, so that the atmosphere may penetrate freely to the roots; for this pur-

pose the well-known shovel-plow is the best and most simple instrument, commonly used in the Western States to cultivate Indian corn. This requires one horse and a man. This plow can go within an inch of the vines, and will consequently destroy all weeds. First the plowman plows one way; and then, when done with the field thus, he plows crossways, by which operation any weed escaping the first plowing will be destroyed without using a hand-hoe. In this way, one man with two horses (one horse in the forenoon and the other in the afternoon) will comfortably plow three acres a day, on an average, in twenty-six working days of the month. All plantations of vines one or more years old ought to be plowed twice a month, as above described, to keep weeds down, and stir up and pulverize the ground, by which means you will charge it with nitrogen. This exposure of alternate stratas of earth to the action of the sun, air, and rain, fertilizes the soil incredibly. Moreover, the weeds plowed under ground by their rotting enrich the soil, and impregnate it with ammonia and humors. Then, a mellow ground is much more adapted to attract moisture from the atmosphere than a hard-caked one.

Pruning, First Year.—When the last plowing at the end of July is done, nothing more in the way of cultivation is necessary until the end of December or beginning of January—the time for pruning. Your vines, if planted as cuttings, will have but small shoots; but if rooted vines, those shoots will be strong, and several of them. In either case you cut the vine back to two eyes, being always careful that all ground-shoots shall be clean cut away from the main stem. Your pruning-knife must be sharp; or, still better, use the grape-vine scissors, which are far superior to the knife, and can be procured at the seed or hardware stores in San Francisco.

When the vine sprouts, which is about the month of March—and sooner in this country—the planter must carefully inspect his new vines, and break all sprouts out from the vine except the two coming from the two eyes left for that purpose. This done, the planter must again put his shovel-plow to work, and cultivate the soil precisely in the same way as last year, described above.

Pruning, Second Year.—Again, at the end of December, the pruning begins, there having been two vines raised on each stem. The one the most feeble or crushed is cut off; the other is left to the length the planter wishes to raise his vine-stem.

[After several experiments, made on a large scale with vines pruned high and staked, and with vines pruned close to the ground, we have become convinced that low pruning close to the ground is the better mode in California; it gives better grapes, and ripens them a fortnight sooner. In consequence of these experiments, I left off, some years ago, high pruning and staking. My travels in Europe have proved to me the correctness of my experiments. There is but one view, that the closer you can keep the grapes to the ground the better they are. It would not do, however, to let the branches lie on the ground, as the summer rains would rot them; but in California and the south of Spain the grapes may and do lie on the ground, and on that account are sweeter.]

Pruning, Third Year.—The grapes having been gathered, the pruning will begin again in December or the beginning of January. This time there are three stems on the main stem. Two of these vines must be cut to two buds each, for making wood (for so-called water-branches or vines), to become the next year the bearing vines, and the third one of these vines cut to four buds, which will be quite sufficient to bear grapes; but if the main stem is quite thrifty, you may leave five buds.

[It has been before observed that where quantity is desired it is detrimental to the quality of the grape; therefore he who intends to make superior wine will do well to prune his vines to two buds instead of four and five. But if only ordinary table wine is desired for home consumption, the recommendation of five-bud pruning may be practiced.]

Pruning, Fourth and Subsequent Years.—Many and various are the opinions in pruning bearing vines. Some assert that the old way, to cut the vine back to from six to ten spurs, and on each spur to leave two or three buds, is the best; but on mature reflection, considering that the stem so cut has to make all the wood, besides to produce and ripen grapes, it is not reasonable to believe this mode to be correct, and, in fact, experiments in different countries and climates have proved this doctrine false. It is a well-established fact that the best mode of pruning is to cut the stem to three spurs each, with two buds, and leave three vines, each two or three feet long, according to the strength of your stem. The three spurs will grow this year wood for the next year's bearing, and the three long vines will grow the grapes. Next season the old three vines which have borne grapes this year are cut off to spurs with two buds each, and the three long

vines originating from the last year's spurs are left to bear grapes this year, and so on alternately from year to year. This mode of pruning will insure a large crop every year, and will not exhaust the vine.

[The above paragraph will stand true in several wine-growing countries in Europe, especially on the Rhine and in some parts of Hungary; but in California, the vines pruned three or four feet long will bear so enormously that the wine will prove inferior; and if the vine bears the blue grape it will hardly become blue, but remains a pale pink, and will not give proper color to red wine.]

Summer Pruning.—The native Californians never used to prune vines in the summer, but let them grow any length they pleased. This is erroneous. Every person, on reflection, can at once see that the sap required to grow and produce vines ten, and often twenty feet long, may be better used if it is forced into the grapes. Undoubtedly the berries and bunches will be larger if moderately trimmed; besides, this trimming is a great advantage when the grapes are gathered, as the picking is so much easier than in an untrimmed vineyard, where every thing is tangled up. The best mode is to cut the tops of the vines to the height of five or six feet from the ground, in the month of July for the first time, and the second time in the middle of August. This operation is done easily, and pretty quick. One man with a sickle tops off about two thousand five hundred a day. Besides the above-named advantages, there is one more, viz., when the top is cut off, every where small vines will spring out and form a dense leaf on the ends of the vines, keeping the grapes growing underneath in a moderate shade, and making them thus more tender, juicy, and sweet. It is therefore a great mistake, practiced often by newcomers from modern Europe, that they will break out the so-called suckers; that is, little branches starting out behind the leaf, and growing feebly up to the length of a few inches. These, in the northern parts of Europe, are broken up, but not in Italy, Greece, Smyrna, etc. Now California having a warmer climate, the vines need more protection against the sun than elsewhere, and experience shows that where some bunches of grapes are exposed, without the shelter of their leaves, to the rays of the sun, the berries remain small, green, hard, and sour.

Crushing.—When the picked grapes are brought to the press-house, they ought to be crushed immediately, and not left stand-

ing in tubs overnight or the next day. The crusher is a simple machine. There are three cast iron cylinders; two of them, of even size, roll against each other; the third one is on top of the two lower ones, and is fluted, for the purpose of taking hold of the bunch and pressing it down to the two lower ones. These latter have very small projections, like a waffle-iron, so as to crush the grapes; but not the grape-seed, which would be injurious to the taste of the wine. I have one of these crushers, made to crush apples for cider, and it answers admirably. Two men crush easily with it five thousand pounds of grapes in a day.

[Opinions vary much in Europe with regard to crushing or stamping grapes with the feet. Our opinion is, that cylinder crushing is as good as treading, if it does not crack the seeds of the grape. Two wooden rollers, eighteen inches in diameter and two feet long, with a hopper on the top into which the grapes are poured, will crush grapes enough to make fifteen hundred gallons per day, with two men in attendance.]

Cost of Planting a Vineyard.—This, of course, will vary with the price of labor, locality, and soil; but to give an idea to persons who have no practical knowledge, I will give here a correct account of the planting of a vineyard of one hundred acres. This was actually expended on the same in labor and money, as I kept a strict account of every thing. The soil is red clay, intermixed with volcanic rocks, partly decayed and partly in the process of decaying. The land had been previously cultivated for grains. This hundred acres was planted in January, 1858.

FIRST YEAR.

Six men (with 9 horses for deep tiller, and 6 horses for shovel-plow), 20 days each, = 120 days, $35 per month wages, and $15 for board: =120 days, at $1 93		$231 60	
Horse-hire 50 cents, feed 25 cents per day: 15 horses, 20 days each		225 00	
Blacksmith's bill, wear and tear of harness		30 00	
Eighteen men laying out, staking, and digging holes, 21 days each, = 378 days; and 6 men planting, 23 days each, = 138 days: wages $30, and board $15 per month, =516 days, at $1 73		892 68	
Thirty-two days' work was spent in digging the rooted vines in the nursery; their cultivation during the summer brought their cost to one quarter of a cent each: 68,000 vines, at $2 50 per 1000		170 00	
Sundry expenses		55 36	
Total cost of planting		$1604 64	
First summer's expense of cultivation, 260 days' work, with board, $50 per month	$500 00		
Horse-hire and feed for 5 months	205 00		
Blacksmith's bill, and wear and tear of harness	15 00		
Pruning, first year, in January	25 00	745 00	
Total first year's expenditure			$2349 64

SECOND YEAR.

Replanting vines which died out from the year's planting and sprouting	60 00	
Summer cultivation and fall pruning, as last year	745 00	
Second year's expenditure		$805 00

THIRD YEAR.

Sprouting and additional expenses for pruning, as this goes slower this year	120 00	
Summer cultivation as above	745 00	
Total third year's expenditure		$865 00
Total expenses of 100 acres up to bearing		$4019 64

Here we may state that wine raised on my vineyard, of the vintages of different years, was taken by me to Europe to be tested by *connoisseurs* of wine, and for its quality and fitness to stand the ocean transportation. It was found by the best judges to stand the voyage well, and was pronounced eminently adapted for the manufacture of Champagne. On our return we visited Kohler & Co.'s California wine establishment in New York, and found their wines very good.

Many of our people are of the opinion that wine-producing may be overdone in California and in the Atlantic States. This fear is totally unfounded; as a proof of which, I will refer the reader to the valuable pamphlet of Mr. B. de Szemere, ex-minister of Hungary, and a resident of Paris since 1859. He gives the number of acres planted in France at 5,000,000, and the produce at 750,000,000 gallons of wine; in Hungary, 3,000,000 of acres planted, producing 360,000,000 gallons.

M. de Szemere classifies France as the first of the wine-producing countries of the world, and still it imports largely from foreign countries; and, furthermore, it is an undeniable fact that millions of gallons of wine are manufactured without the aid of a single grape.

The exact words of the author on this subject are as follows:

"But there are other, and, indeed, culpable methods of adulteration very injurious to health. The marvelous discoveries which are daily made in chemical science are continually and skillfully applied, not only to improve, but to adulterate the wines. In this manner do the Germans sweeten their wines; in this manner they saturate them with sulphur, with a view to neutralize their natural propensity to become acid, not only in casks, but even in bottles; in this manner they give them the artificial, but to connoisseurs disgusting flavor of Muscat. This trade of spurious wines is carried on in France on a still larger scale. All is false

in the wines; the color, the strength, the flavor, the age—even the name under which they are sold. There are wines which do not contain a drop of grape-juice. Even science is impotent to distinguish the true from the false, so complete is the imitation. You may every day see advertised in the French newspapers the *Sève de Médoc*, of which a small flaçon, costing three francs, is declared sufficient to give flavor to 600 litres.

"Paris and Cette are the principal seats of this fraudulent adulteration. It is practiced in both places on the most colossal scale. Certainly one half of the Parisian population drink, under the name of wine, a mixture of which there is not one drop of grape-juice. The police are unable to prevent this adulteration; but the laws punish it with great severity. Every week do the newspapers publish judgments against wine-merchants and grocers, in execution of which their wines—twenty, thirty, eighty hogsheads at once—are poured into the gutters. But this dishonest art is now so perfect that even clever chemists can with difficulty distinguish the true wine from the false. Such was the case in a very recent trial. The chemist, after reporting every ingredient of which the wine was composed, observed that if one of them were in less quantity he would have been unable to distinguish it from the natural wine. The prosecuted wine-merchant, who was present, listened attentively to the chemist's report, and at last asked him which ingredient it was. The chemist very imprudently told him, and the accused immediately answered, "I am very much obliged, sir; and I don't regret now my forty hogsheads of wine which will be destroyed, because now I am certain of my business.

"The quantity of the French home consumption is exactly known. Taking, as an example, the year 1857: France produced 35,410,000 hectolitres; she imported, besides, foreign wine, 626,000 hectolitres; total, 36,026,000 hectolitres. Of this quantity, in France was consumed: as wine, 17,142,000 hectolitres; as spirit, 2,453,000 hectolitres; as vinegar, 222,000 hectolitres; total of the French consumption, 19,817,000 hectolitres. We see that what is left for stock and exportation is not too much, and still less if we consider such years as 1854, 1855, 1856, in which the total production was only 10,000,000, 15,000,000, and 21,000,000 hectolitres, instead of 35,000,000, as it was in 1857. If, therefore, France itself, in 1857, consumed more than she can produce in some years, is it unreasonable to doubt whether she would always be able to export natural and unadulterated wines? In any case, can one believe that under such circumstances old French wines could be found any where but in private cellars?"

About Hungary and its wines he says:

"1. With the exception of six counties, the vine is cultivated in all Hungary (in France *eleven* departments have no vines, and

twenty-five departments produce only common wines unfit for exportation). Every wine has its name, derived from a town, a county, a mountain, or a lake. Some large districts are celebrated for their wines; but even in small and less-known localities excellent wines are to be found, concealed like treasures which only wait to be discovered. The most renowned wines are:

LIQUEUR WINES.

White.		*Red.*	
Tokay.	Soprony.	Ménes.	Villàny.
Ruszt.	Szent Gyœrgy.	Eger.	Kàrloviez.

TABLE WINES.

Érmellék.	Ménes.	Szerednye.	Villany.
Bakator.	Eger.	Neszmély.	Visonta.
Somlyó.	Szegszard.	Kœbànya.	Kàrloviez.
Balaton.	Badacsony.	Borsod, etc.	Nógrád, etc.
Buda.	Magyaràt.		

"Numberless are the varieties of wines, for they vary in every respect: in color, from dark to pale red, from green to golden-yellow; in strength, they are light or strong; in taste, dry or sweet, with more or less flavor. It may be that one or another may not suit one's taste, but it is impossible that every body should not find among these different wines one agreeable to him. What is necessary is to try all, and afterward choose the most suitable.

"2. The Hungarian wines are generally stronger than the French or the Rhine wines. The reason of this may be sought in the kind of grape, in the properties of the soil, in the peculiar climate of the country, and finally, I think, in the fact that in Hungary the vineyards are commonly situated upon elevated hills, I dare even call them mountains. The Hungarians, knowing the old Latin proverb, *Bacchus colles amat* ("Bacchus loves the hills"), have followed the advice; they even now laugh at and despise the wines growing in the low plains, which is the case with most French wines.

"And this is not all. Two contrary tendencies are very perceptible in the two countries. The demand for French wines being great, the French cultivators, for thirty or forty years past, have left the finest wines out of account; they prefer the inferior sorts at a low price to the finer at a high price; they plant the vines close together, thus depriving the fruit of sun and air; they choose a rich soil, which gives a more abundant but an inferior produce; they, with the same object in view, make too much use of manure, which injures the quality of the wine (a practice once forbidden by *law*); in a word, the French wine has lost in flavor what it has gained in fecundity; quality has been sacrificed to the quantity.

"But in Hungary the contrary still prevails—that old system under which the quality is the principal object in view, under which a favorable exposure is the all-important consideration;

and the poor, light, stony, granitic land, from whence alone the choicest and the most highly-flavored wines can be obtained, is preferred to a rich, manured soil, insuring an abundant, but, in quality, far inferior return.

"Nothing is grander or more beautiful than our mountains, crowned either with shady woods or with vines of exuberant vegetation. Where you see a mountain, there you will find our vineyards. The superb *Badacsony* mountains form a high semicircle around the majestic Lake of Balaton, covering a surface of one hundred and twenty-five English square miles. The arid mountains of Ménes or Vilàgos overlook proudly the rich plains of Bànat, the holy Canaan of Hungary. The mountain called Tokay rises, in an another large plain, like a lofty pyramid. It has the form of Vesuvius, and, indeed, its existing but silent crater, its volcanic formation, shows evidently that it was once a fire-spreading mountain. The cultivation of such a soil is very difficult and expensive, the produce obtained but little; but then the latent fire of this volcanic mountain is what we call Tokay wine.

"Now I do not mean to say that the best wine is that which contains the most alcohol; this is only one of its elements; and other qualities, as delicacy, taste, flavor, are equally essential. My intention is to establish that, as the Hungarian *natural* wine is stronger than the Rhine, French, or even Spanish or Portuguese wines (taken without the usual addition of brandy), we may reasonably presume, first, that the Hungarian wine is particularly adapted to the English climate, and then that it will, more than any other light wine, facilitate to the English consumer the transition from the spirits and brandied wine to natural ones, which are undoubtedly more beneficial to the human health.

"It is a fact universally known, that to all wines exported to England is added more or less brandy (and in most cases not Cognac, but what is quite another thing, corn, fig, sugar-brandy); thus the Rhine wines receive an addition of 2–5, the French 4–7, the Spanish and Port wines 8–15 per cent. of alcohol.

"This practice is in Hungary quite unknown. Notwithstanding the mentioned addition of brandy, the Rhine wines never mark above 10–14 degrees (of Sykes), and the *best* clarets, like Château Lafitte, do not reach 18; whereas the quite pure and natural Hungarian wines, when examined by the Custom-house Test Office in London, gave the following results:

Buda, red table wine	21.1	Neszmély, white table wine	19.4
Eger	21.5	Balaton	20.6
Szegszard	22.8	Bakator	20.6
Ménes, 1842	23.	Tokay dry	23.6

"But I think there could be found inferior wines not surpassing eighteen degrees; consequently their introduction (at the shilling duty) would be very advantageous to the great mass of the English consumers.

"3. In the third place, I will say that if there be a country where *real old* wines (from 1811 to 1855) are to be found, it is Hungary. This important fact has its reason: *first*, from this circumstance, that Hungary, like England, is the land of large estates. There are landowners producing yearly from 1000 to 20,000 hogsheads of wine. Beautiful and enormous cellars, cut in rocky mountains, widely extend their ramifications, like labyrinths or catacombs, where the wines are ranged year after year. It is a kind of aristocratic and family glory to have a full and rich cellar. The grandchildren can drink the wine produced by their ancestors, and gratefully remember the past old times. Some of them would not sell their wines, even if they could do it; but that is not an easy matter in Hungary. Why? Because, and that is the *second* reason, the internal consumption with us is very small. In Hungary the ladies never drink any thing but water; the men of the higher classes are temperate from principle and habit; the lower classes from necessity and custom. Therefore, in proportion to the number of inhabitants, little wine, and scarcely any wine brandy, is consumed; so that, I dare say, Hungary, with France, the richest wine-growing country in the world, is at the same time the most temperate.

"Is not this fact an argument to show that the light and natural wines are the most efficacious and surest preservatives against the use of fiery, intoxicating brandies?"

The above extracts will satisfy the skeptic that where commerce exists and transportation is easy, there need be no fear of overdoing the business of vine-raising. California possesses the commercial advantages, as well as facility of communication, between producer and merchant. The merchant can send his wine to foreign markets after it is one year old without adding a drop of brandy, as our wine will, as I stated before, bear transportation, and even improve beyond expectation. The time so spent on the sea is not lost, for the wine gets older and better, and will, in consequence, meet a better sale.

We give below a table of the wine produced in Europe, the quantity reduced from morgens to acres. Our statistics were extracted from a work by Gustave Rawald. Also the price and yield per acre of wine calculated in dollars. These calculations were made by ourselves from the figures given in the above work.

THE AVERAGE WINE PRODUCTION OF EUROPE REDUCED TO AMERICAN ACRES AND GALLONS.

	Acres.	Gallons.	Gallons per Acre.
Austria and her Provinces.........	2,685,950	714,000,000*	265$\frac{5}{6}$
Greece and the Grecian Islands...	41,781	8,160,000	195$\frac{3}{10}$
Ionian Islands (for raisins, over 42,000,000 lbs.)†	35,812	1,224,000	34$\frac{1}{6}$
Italy..................................	2,887,970	1,275,000,000	441$\frac{1}{2}$
Switzerland and Belgium..........	76,400	2,550,000	33$\frac{3}{8}$
France................................	5,013,774	884,000,000	176$\frac{2}{7}$
Spain	955,004	144,500,000	151$\frac{7}{10}$
Portugal	238,751	25,500,000	106$\frac{8}{10}$
Total....................	11,935,442	3,054,934,000	255$\frac{95}{100}$

Germany.

	Acres.	Gallons.	Gallons per Acre.
Saxony..............................	5,945	340,000	57$\frac{1}{6}$
Prussia	53,719	7,225,000	134$\frac{1}{2}$
Bavaria..............................	125,344	20,400,000	162$\frac{3}{4}$
Wirtemberg	65,656	10,200,000	155$\frac{1}{3}$
Baden	65,656	7,140,000	108$\frac{3}{4}$
Hesse	23,875	4,250,000	178
Nassau...............................	10,143	2,550,000	237$\frac{1}{3}$
Total....................	350,338	52,105,000	148$\frac{72}{100}$

The aggregate number of acres under wine culture in Europe is 12,285,780.
The total average yield per year in Europe is 3,107,039,000 gallons.

The wines of Germany would bring, at 25 cents per gallon........	$13,026,250
And those of the other countries, " " "	763,733,500
Together..	$776,759,750

In Germany the average income per acre would be thus.................. $37 18$\frac{3}{4}$
In the other countries, taken together, per acre would be thus.......... 63 98$\frac{3}{4}$

But, taking each county or state separately, their wines would bring, upon the above average price of 25 cents per gallon, as follows:

European Countries.

	Total Amount.	Per Acre.
Austria and her Provinces......................	$178,500,000	$66 46
Greece and the Grecian Islands	2,040,000	48 82
Ionian Islands	306,000	8 54
Italy..	318,750,000	110 37
Switzerland and Belgium.......................	637,500	8 34
France...	221,000,000	44 07
Spain	36,125,000	37 92
Portugal	6,375,000	26 70
Total..................................	$763,733,500	

German States.

	Total Amount.	Per Acre.
Saxony..	$85,000	$11 79
Prussia..	1,806,250	33 62
Bavaria	5,100,000	40 68
Wirtemberg	2,550,000	38 83
Baden	1,785,000	27 18
Hesse	1,062,500	44 50
Nassau	637,500	59 33
Total..................................	$13,026,250	

* Of these 714,000,000 gallons, Hungary produces some 450,000,000.
† Cephalonia exports annually 4,200,000 lbs. of raisins; Thiaki, 350,000 lbs.; Zante, 8,000,000 lbs.

We have taken a low estimate, according to present prices, but still it amounts to the enormous sum of $776,759,750. This amount the producer receives; so that it would be safe to calculate that the merchants receive from the consumers double this sum.

Italy shows the highest yield to the acre, and yet does not come up to the California yield within 100 per cent.

It is well known that California has within its boundaries at least 5,000,000 acres of land well adapted for the vine culture. This land, even though it yield no better than Italy, will still amount to $551,858,208 33. This large sum may astonish the most sanguine; nevertheless, in another generation California will produce this result.

Below we give an abstract of the Wine Chronicle of Germany, taken from the Records of the Agricultural Society in Wirtemberg. These Records, dating from the year 1246, are from that time up to 1420 very meagre and much interrupted, but from 1420 up to 1852 quite complete and correct. During those 432 years there were, as to quality of the wine,

Those eminently distinguished only	11
Very good years for a good wine	28
Pretty good ones " "	118
Middling quality wines	76
Inferior " "	199
Total	432

Concerning the productiveness, there have been

Years of ample yield	114
" middle "	18
" poorer "	99
" failures, or yields not paying expenses	201
Total	432

This statement gives a clear view of the disadvantages under which the culture of the grape is to be carried on in such a northern locality as are most of the States of Germany. While we have in California no year of failure on record, or by the tradition of our oldest settlers, cold Germany has her vine crops killed or seriously injured, upon an average, three years out of four. This simple fact evinces the superior advantages of California for the production of grapes and wine.

APPENDIX A.

WINES AND THEIR VARIETIES.

EXTRACTED FROM JOHANN CARL LEUCHS' TREATISE ON WINES AND WINE-MAKING (*WEINKUNDE*): NUREMBERG, 1847.

APPENDIX A.

JOHANN CARL LEUCHS ON WINES.

I. Constituent Parts of the Grape.—II. Hungarian Wines.—III. Rhine Wines.—IV. Franconian Wines.—V. Other German Wines.—VI. Italian Wines.—VII. Spanish Wines.—VIII. Portuguese Wines.—IX. Madeira Wines.—X. Cape Wines.—XI. Greek Wines.—XII. Grape Culture in Turkey, Persia, etc.—XIII. Grape Culture in Africa, America, Russia, etc.

I.

CONSTITUENT PARTS OF THE GRAPE.

SINCE unadulterated wines are made from grapes, it will be here not superfluous to enumerate the constituent parts of the latter. They contain, besides water, tartaric acid, saccharine matter, gum and other slimy substances, wax, tannic acid, albumen, resinous coloring matter, fibrin, odoriferous matter, coloring matter, astringent substance, tartar, sulphate of potash; chloride, sulphide, phosphate, and citrate of calcium; and more or less impurities adhering to the surface, such as particles of the soil and the like. Of these ingredients, the acids, the slimy substances, and the astringent matters are chiefly found in the green grapes, but disappear more or less with their progressive ripening, being by the working of nature transmuted into sugar. These enter also into the must, but to a great part separated during the fermentation, viz., the fibrin, the wax, some coloring matter, a part of the albumen, the resinous matter and slimy substances, with the earthy and other impurities, which settle as lees on the bottom of the barrel, together with the tartar, a part of which incrusts also the sides of the vessel.

1. Water constitutes the principal part of wine, for the best ones contain at least sixty per cent. of it, the poorer wines eighty and even ninety per cent. The grapes will be more watery, and consequently the wine more weak, in wet years; or if they grow in a moist soil; or if rains predominate shortly before or during the vintage.

2. Tartaric acid is found in the stems, in the tendrils, and in the green grapes themselves—partly free, and partly combined with potash.

3. The saccharine substance is formed by the ripening of the grapes, and this takes place the more successfully the more the grapes enjoy the heating influence of the sun. The saccharine

matter is decomposed by the fermentation and transmuted into alcohol.

4. The gum and other slimy matters are not injurious to the wine except by impeding the clarifying process.

5. Wax and resinous coloring matter are found in the husks of the grapes.

6. Tannic acid and other astringent matters give to the red wines a tart and harsh taste if fermented too long upon the stems.

7. The albumen found is only in a moderate quantity in the grapes, and settles easy with the lees.

8. The odoriferous substance is in some kinds of grapes more copious, for instance, in the Riesling and in the Muscats; and if these are mixed in a certain proportion with the others less odoriferous, a fine bouquet is imparted to the whole mass.

9. The coloring matter has its place on the inner side of the husk, from which it is disengaged during fermentation; therefore the longer the red wine is left in the fermenting-tub on the husks, the deeper will become its color.

10. Most of the above-mentioned neutral salts will also settle with the lees, and partly crystallize out of the wine the older it becomes.

II.

HUNGARIAN WINES.

1. We will here mention the most celebrated wines of Hungary. The first is the world-renowned Tokay. Of this there are four kinds—three sweet, and one so-called table wine. Of the sweet wines the first is the "Essence," which is collected in vessels put under baskets containing the half-dried grapes (*Trokenbeere*), the juice of which drops by its own weight partly out. The second quality is the so-called "Ausbruch," made in the following way: when the above grapes do not yield more "Essence," they are taken out from the baskets and put into some flat vessel, and there, by treading, converted into a pulpy mass, which is then transferred into an open barrel, and the proper quantity of good must added (to eighty measures of the pulp, one hundred and fifty measures of must), and well stirred up. As soon as the mass is fermenting the whole is again well stirred, and then put into a loose sack and squeezed out, then filled into clean barrels to finish the fermentation. The third quality is called Mászlás (pronounced *Maslash*), made from the squeezed pulp in the above-specified way. The fourth kind is made from the ripe grapes in the common way.

2. The wine of "Ménes" (*Menesh*) is also a sweet wine, not much

inferior to the Tokay, but red in color, while the Tokay is yellow. There the blue grapes are handled in the same way as the white ones are for the Tokay.

3. The wines of Sirmia. The sweet wines of this province, as well as the others, are also of eminent quality, though they are sold mostly under the name of Karlovizian wines; those of other places in this district are entitled to no less credit for their excellent virtues, as, for instance, those of Illok, Suseg, Cheslevitz, Beoscin, Rakovatz, Kamenitz, and Peterwardein. The red Sirmian wine is sweet, very aromatic, dark red, and mild. The white wine is too spirituous to be drank by itself, and is used to improve poorer wines. Besides those wines they prepare the so-called "Dropwermuth," named from the process for collecting it from linen filters, which, being suspended in a very heated room, the must falls from the filters in drops into the vessels beneath. This half-fermented must remains in small casks for several months sweet, and has some similarity to the Champagne. Another kind of wine there manufactured is the so-called "Rascian Wermuth." The barrels are nearly filled with half-dry blue grapes, without stems, and then a good old red wine is poured over them, with some wormwood and spices.

4. The wines of Buda (Ofen) are also celebrated for their fine qualities,—especially the red ones of Buda and its environs, and the white ones of Pesth, in the same county—and called "Steinbrucher."

5. The wines of St. Endree are also very fine, agreeable to drink, spirituous, and aromatic. Here are also sweet wines made from dry grapes.

6. Sekzardy wines may successfully compete with the best Burgundy.

7. Pétshy (Fünfkirchen) produces good table wines, all of white grapes.

8. Villanyer wines remain sweet even when many years old.

9. Neszmély furnishes one of the best table wines known, the peculiar aromatic taste of which can not be found in any other wine. It attains its maturity in from three to four years. It is a pity that the spots where these magnificent grapes grow are so limited in circuit. The average product of this wine amounts yearly only to ten thousand barrels, a gallon of which sells commonly for from fifty-five to sixty cents, while other common table wines can be bought in Hungary for four to five cents.

10. A rival to the Neszmély is another white wine, namely, that of Shomló. Some even prefer its aromatic taste to that of the Neszmély, though quite of another bouquet, and many consider it the best wine for the table. Its grapes grow upon a basaltic hill of limited size; the average yearly product is about 25,000 barrels.

11. Rust and Œdenburg have also excellent sweet dessert wines, well-flavored and spirituous.

12. Besides many others of first-rate quality too numerous to mention, there are also of prominent notoriety the wines of Visonta, Erlau, Presburg, Ratchdorf, St. George Posing, Modern, Gruan, Limbach, Tyrling, Shenkvitz, Ducova, Nusdorf, Neustadt, etc.

13. Among the wines of Croatia is the Moslavina, equal to the Burgundy; the Babulek and Bukovetz, the most prominent for their rich aromatic savor and strength.

14. The wines of Banat, in Lower Hungary, are also generally, on account of the warm climate, very spirituous, mild, and spicy. The best of them is furnished by Vershitz, near the Turkish boundary, and Weiskirchen.

To give a slight insight into the enormous wine production of Hungary, I will here mention only a few instances: Promontory, a single hill, 55,000 barrels a year; Teteny, a village, 65,000 barrels yearly; St. Andree, a village, 70,000 barrels; Ménesh, 470,000 barrels; Pétsh, a town of considerable extent, 500,000 barrels; Tolna County, 700,000 barrels. In this county the village of Seksard alone averages yearly 250,000 barrels, and the county of Pest 255,000 barrels. Hungary may be therefore rightly classed among the first vine-growing countries, her wine produce being neither in quality nor quantity second to any other country upon the globe. Francis Schams, in his celebrated work, estimates the yearly average yield at 30,000,000 barrels. One thirty-second part of the cultivated lands in Hungary is planted with grape-vines.

[For an account of the wine products of France the reader is referred to other portions of this volume.—A. H.]

III.

THE RHINE WINES.

Both banks of the Rhine, from its outlet, several hundred miles in circumference, up to the city of Bonn, display to the eye, with but little interruption, their innumerable vineyards. All the wines which are made in these districts should properly be called Rheinwines; but, for the purpose of each particular wine being the more easily distinguished from that of any other, the name of the particular district where each kind is produced is commonly adopted as the title of the wine, namely, Elsasser, Seawine, Marggräffer, Aarblischer, Zaardtwine, and Naahwine.

Those wines only which are called "Rheingaus," and those made in the vicinity of Mayence and on the left bank of the river, are by custom designated by the especial name of "Rheinwines;" and, indeed, these sorts are eminently entitled to this mark of dis-

tinction, as they possess, more than any of the others, those peculiar qualities which distinguish the Rhine wines. After a few hours' travel from Mayence on the right bank of the River Rhine, you begin to enter upon the more favorable regions for the culture of the vine—the so-called "Rheingau." Here the most celebrated wine districts are the following: Asmannhausen, Rüdesheim, Geisenheim, Johannisberg, Markobrunn, Steinberg, and Hochheim, which lies toward the east.

Next in quality to the wines produced in these districts you may class with perfect certainty those made on the left bank of the river: *e. g.*, those of Scharlachler, Ingelheim, Laubenheim, Bodenheim, and Nierstein, all of which places are in the vicinity of Mayence, and whose wines are not unfrequently found to give satisfaction even to the ablest connoisseurs; for, even if the stringency and spiciness of the first-named class of wines can not be attained by these other kinds, yet these districts have afforded wines which, by their sweetness, bouquet, and strength, have obtained for them a considerable degree of public estimation.

The vineyards also toward the south and southwest afford unexceptionable wines. Nature, however, has not provided in every part of this wine-country a soil so congenial to the culture of the grape as she has in the Rheingau. There the soil attains its highest perfection for the production of choice wines; there flourish the richest vineyards, which produce the most generous wine, the vines themselves growing generally in stony ground or in the clefts of rocks. On the southerly side of these tracts the sun shines the whole day long; its rays warm the stones to the greatest intensity, and, by the radiation of heat therefrom, the grape is ripened by the solar influence to an equal perfection with those which are fully exposed to the direct blaze of the sunbeams. A high degree of vinous essence is consequently developed in these grapes—an element which would be sought for in vain in any other part of the Rhine. The fact is announced to you from a distance by the smell of the air, which is impregnated with the sweetness and spicy odors arising from the vineyards. Besides the districts above enumerated, whose vintages take the pre-eminence of all others in the Rheingau, there are many other places which, in a greater or less degree, are suited to the growing of vines of various varieties.

All the wine districts on the Rheingau, with the exception of the Burgundy vines, from Asmannhausen, produce only white wines. Opposite the Rheingau, on the left bank of the river, red wines are produced also, as at Ingelheim and Lorch, near Mayence, and several other places. The latter place, like the Asmannhausen, in the Rheingau, affords Burgundies of superior strength and piquancy, but never excels in sweetness or purity. The finest Rhine wine comes indubitably from the mountainous regions of Rüdesheim and Hinterhaus. The variety of grape

cultivated in these mountain sites is called the Orleans or Harthengst: these differ from all the native grapes of the Rhine. They are very large in size and exceedingly aromatic, and in favorable seasons they become extremely sweet. This accounts amply for the fact that, in the year 1822, four thousand Rhenish florins were paid for one pipe (about 280 gallons) of Rüdesheimer wine—about $14 28 per gallon. In the year 1815, 1200 such pipes of wine were raised in Rüdesheim, and 1400 pipes in the year 1819. This wine is appreciated for its strength and pleasant flavor. It differs from the mountain wines made from the Orleans grape, of which the average yearly product is fully 150 pipes. The Oberfelder and Riesling grape also produce from 400 to 500 pipes, and Hinterhaus yields annually from 10 to 12 pipes. In the year 1809, the price of a pipe of these wines was 3000 Rhenish florins in Rüdesheim; in 1800, 1800 florins; in 1804, 750 to 900 florins.

Almost equally esteemed are, first, the wines of Steinberg and Johannisberg; next, those of Rothenberg; next, Geisenheim; fourthly, those of Markobrunn and Gräfenberg, near Kiederich. All these wines are produced from a grape called the Riesling. This grape is inferior to none in bouquet, fineness, and sweetness. One pipe of the Steinberg vintage was, in the year 1822, sold for the sum of 5000 florins ($7 14 the gallon). The vineyard belongs to the estate of the Duke of Nassau. All these wines have, as we mentioned before, obtained, from their remarkable spiciness and odor, their exquisite flavor and piquancy, an especial public preference, so that the wine-growers will readily make an outlay of thousands of dollars in a vineyard of this description.

The best fruit for the production of this wine is grown in the upper regions of the mountains, where it is protected by the chateau. The next in quality of this wine is produced from the grapes cultivated in the central parts of the mountain heights. The most inferior kinds are produced from vineyards at their base. The soil consists of slate.

During the process of the vinous fermentation, the bung-hole of the cask is covered with a patch of paper, upon which is placed a brick. After the fermentation has ceased, the barrel is replenished, and a bung with a valve is put on, so that, in case of a second fermentation occurring, the carbonic acid gas evolved by that process can readily escape.

During the first year the wine is drawn off three times; in the course of the second year once or twice, so as to clarify it sufficiently; and it is only after a period of four or five years that the wine becomes sufficiently ripened for the final operation of bottling off, after which it can be kept for a period of twenty-five years or even more. To prevent any sediment, the wine has, in the first place, to be cleared. When the wine is drawn off, it is

pumped into troughs, which conduct the stream till it flows into the bung-hole of the cask, by which process the whole volume of wine becomes more thoroughly mixed.

Here the wine is never carried in buckets, or poured from them into the barrels, because, by exposure to the atmosphere, wines made from the juice of rotten grapes would be turned into a brown color, which discoloration, although it will partially disappear in time, yet the body of the wine itself will, notwithstanding, be always of a darker tint than usual.

During the first, second, and third years the valve-bungs are affixed to the wine barrels. These are shaped like an ordinary bung, but they have a small perforation through the centre, which is closed up by the insertion of a cork, adjusted by a steel spring. which apparatus affords a free escape for any evolution of gas.

On the 17th, 18th, 19th, and 20th days of October, 1831, the work of picking the grapes began, continuing from noon until four P.M. On the southerly sites, where the grapes had become rotten-ripe, the gathering of the balance was commenced on the 27th. 28th, 29th, and 30th of the same month, and was continued until the 5th of the following November, when the picking was finished. On the 27th and 28th the two best vineyards were selected. and their choice fruit picked separate and kept apart from the rest. This work, although slow in being performed, paid for itself well; for, after fermentation, the must remained as thick as Malaga, and before the processes of making the wine were completed it sold for no less than 10,000 guilders the pipe, or $14 28 the gallon.

The Cassel vineyard contains 63 morgens, the annual produce of which is 25 pipes; each pipe contains 1300 bottles, worth 24,000 florins. In the year 1818 they raised 47, and in 1819 52 pipes of wine.

This wine contains a large proportion of spirit, and is very palatable. It ranks in quality with the best wines extant. It is made from the Riesling grape. These grapes are left to ripen thoroughly, and not until the wine is a year old is it drawn off the lees.

The following years have produced good vintages: 1794, 1802, 1804, 1811, and 1822. In 1819 the price per bottle of first class wine was four florins, of second class three, and of third class one and a half. At Hochheim (one hour's ride from Mayence) the vines grow on an elevated table-land, which verges toward the main, and covers an area of 1200 morgens. Its site is exposed fully to the sun, but has little protection from the north winds: and it is, therefore, to the vicinity of the river that this wine owes its excellence.

The price of one morgen (a little over half an acre) of vineyard near Mayence is 2000 florins; toward the centre of the heights, 1000; and on the tops, 500 florins. The most preferable locality

lies in the direction of the Dechanci, and the choicest spot there is what is called the "Church Piece." It lies contiguous to the church itself, which probably shelters it from the northerly winds on one side, and radiates the light and heat of the southerly sun on the other.

In good seasons a barrel of Rhenish wine realizes the sum of 5000 florins.

Here the owners of extensive vineyards pick their grapes as soon as they begin to rot, and the gathering of such clusters as are not found in this condition is deferred to a later period, till it arrives. The berry must be of a light-brown color and opaque, not green and transparent; the kernels brown and not white; the fruit itself of a sunburnt and sweet taste to the palate; the vine-stem must be in a dry and sapless state.

The entire bunches of the Riesling grape are deposited in a treading-tank, and are crushed by the feet of the laborers. By this operation the bouquet (which originates from the part of the inner side of the husk) will be easier extracted, and the wine much more flavored; still more so if the must thus gained remains undisturbed for twenty-four hours. After this interval, the husks are thrown into the ordinary wine-press. The fermenting process is carried on in the barrel, the bung-hole of which is covered either with a vine-leaf or an inverted bung. The bungs used for this purpose are eight or nine inches long, which are plunged to half their length in the wine. By this means the bungs are constantly soaked by the wine, which causes them to swell and fit better to the vent of the barrels.

In Eelfeld, the largest town in the Rheingau, situated close upon the River Rhine, the vintagers pick the rotting grapes first.

The crushing of the berry is seldom performed by the wine-mill, but, for the most part, is done in the tread-tub, as the bouquet is by that means more readily extracted. The press is generally used, however, immediately after the treading by the foot, when the fruit is very ripe; but in less ripe grapes an interval of twenty-four hours is suffered to elapse before the mechanical pressing operation is performed. The fermentation is carried on in separate barrels, which are hermetically sealed by water. It is not considered that the wine itself is benefited by this mode of treatment, but it is adopted rather for the sake of security to the work-people, as it prevents the escape of the carbonic acid gas into the vaults where they are employed.

Steinberg—a quarter of an hour from the convent of Eberbach—produces, by its skillful management, an excellent kind of wine. It yielded in the year 1819 eighty-four pipes. Here the grapes are gathered as late in the season as possible, and they are never cleared off from the vines at once, but in two or three different pickings, as they become fit for use. The work is done here two or three weeks later than in the Rheingau, and care is taken never

to gather the fruit while there is any dew on it. Here also the grapes are crushed by the feet, and the grinding-mills are no more in use. In a season of failure the fruit is put through the press as soon as it is brought in from the field; but in good seasons it lies for twelve or eighteen hours before it is pressed, so that the saccharine matter may become fully developed. Separating the berries from the stems, which was formerly done, is now dispensed with, as of no account and expensive; for the stems at so late a vintage are too dry to impair the quality of the wine.

The red wines of Asmannhausen, in the Rheingau, are also of a very valuable description. In strength they excel all others made on the Rhine, not excepting even Burgundy itself. They possess a peculiar spiciness which is rarely met with. The narrow limits of this tract, however, permit the cultivation of but few vineyards.

The preparation of the wine, as practiced in the Duke's cellars at Rüdesheim, is as follows: The grapes are pounded together with a must-club, and then conveyed to Rüdesheim; there they are thrown *en masse* into a square trough with a flat bottom of wire gauze, underneath which is another vessel into which the berries are swept with a stiff besom, passing through the wire sieve, and falling into the vessel beneath. After this operation, they are mashed together with wooden pounders until the whole is pounded into a pulpy mass.

The fermenting of red wines is conducted thus: Tubs are placed vertically, in which a faucet is inserted at the lower edge; over this hole a perforated little board or tin is nailed, to prevent the husks from entering the faucet and obstructing the passage of the wine. Thus the wine will run freely through the faucet without being clogged up by the pulp of the grapes. Into these tubs, thus fitted up, the conglomerated mass of mashed grapes is put so far as to fill them up to within a quarter part of the top. Then a cover, perforated with small holes, is fastened with some three or four props over the mass, so that, when the same commences to ferment, and consequently rises, nothing but the carbonic acid gas and the fluid part of the mass can penetrate through those small holes, of which the former two will virtually prevent the atmospheric air from mixing with and souring the husks, which, on their part, would communicate this sourness to the wine. After the above precaution is taken, a well-fitting cover is inserted and luted air-tight. Into this cover a curved tin or glass pipe is inserted, the upper end of which is put into a small vessel filled with cold water. The water will absorb the carbonic acid gas, so deleterious to human life; but the water, becoming saturated with the gas, must be renewed daily. Thus the whole is left until the fermentation is complete, which commonly will take place within three weeks. After this the fluid part is decanted through the faucet; the cover, together with the perforated board, is removed, and the husks properly pressed, each kind of the juices being fill-

ed by itself into barrels; the former making a wine of the first quality, while the press wine is of an inferior grade. Red wines are generally drawn off in the March following the vintage, and sold in four or six weeks after. What stock remains on hand is drawn off again in the following October.

It is to be remarked that, by an excellent arrangement, the must wine can be conveyed by hollow tubes directly from the press-house to each cask in the cellar. The method above described is the best that can be adopted for the making of red wine. All other modes are attended with the disadvantage of a too long exposure of the must to the open air, which gives it an acidity. The above process totally obviates such a tendency, as all contact with the atmosphere is excluded by the water. The red wines of Ingelheim, though lighter in quality, nevertheless keep better than those of Asmannhausen. They raise a good deal of wine here—one *ohm* fetches from five to six *carolins*, whereas the genuine Asmannhausen costs at least ten carolins.

Scharlachberg, near Bingen, produces white wines which command a good price; they do not, however, attain so high a figure as the choice Rheingaus, as they lack the strength and bouquet of the latter sort. In good years, fifteen hundred florins per barrel are paid for the very best Scharlachberger wine.

Nierstein has been long famous for its wine, which is celebrated for its good and wholesome qualities. A great quantity of it is made, and the best Niersteiner fetches one thousand florins per pipe.

The wines of Bodenheim and Laubenheim are in general twenty per cent. lighter in quality than the above, and they are thus proportionately cheaper. There are some exceptions, however; nor is it surprising that, throughout the genuine wine districts of the Rhine, some superior sorts should be found; and more especially will this be the case when once it becomes a general rule to make their wines only from choice and very ripe fruits, and to divest the berries of every particle of green stalk. Already has this method been practiced for years past by the more intelligent wine-growers, and their success has set a good example, inasmuch as by adopting this plan the advantage is gained of its not being found necessary to lay up the wine in barrels for years in order to render it mild; but, on the contrary, it soon becomes fit for consumption, and, finding a speedy market, there is a quick return of the capital invested, which is not suffered to lie idle.

Formerly it was customary to draw the wine off into large hogsheads, but now they select their different kinds of grape for their several sorts of wine, and draw it off into small-sized barrels.

The wines from the left bank of the Rhine possess, generally, less body than those of the right, but they are finer in quality, contain more alcohol, and have a most excellent bouquet. Rheinhessen transports from Worms to Bingen several kinds of very

good wine; *e. g.*, in the year 1818, fifty thousand pipes; in 1819, ninety thousand half pipes.

We shall here enumerate the best wine districts, and describe the various methods of making wine therein, founded upon Brouner's system.

Karlebach. Here the wine is made in the same manner as at Hardt, with the difference only that the grapes are mashed with pounders instead of in the tread-tank with the feet; and in many instances the wine-makers crush the fruit with rollers for the sake of expedition, as one man, in the same time, will crush with the roller as much fruit as three men can mash with the pounders.

Worms produces the Liebfrauenmilch, and also those wines of somewhat lighter quality—the Katerloch and Luguisland. These are the most celebrated wines. The wine-presses in use here are of small size.

The Liebfrauenmilch is an excellent wine, made from grapes which grow on the site of the very battle-field where, in the year 1689, Louis XIV. completed his murderous design—in the suburbs of Mayence. The best in quality of this wine is raised on the plantings which lie in contiguity with the monastery of what is supposed to be the Liebfrau Order. In 1822 this wine brought fifteen hundred florins per pipe. Its superior qualities appear to be owing to the protection afforded to this particular site by the church building from the north and northwesterly winds, also by the genial warmth produced by the shelter of its walls. The soil is red clay with gravel intermixed. The wine is fermented in the barrels, which are slightly covered. It is first drawn off the lees at Christmas time, and again in the following autumn.

Westhofen. Here they draw off the new wine twice, once in April and again before the next vintage.

Osthofen, Bechtheim, Dienheim, Oppenheim. At these places they draw off the wine three times in the year. They also train vines on trellis-work, but the wine they yield is bad, on account of the height of the fruit from the ground. The wine made from the fruit which is grown aloft in these arbors is worth only three hundred florins per barrel, while that which is raised on low rails will fetch five hundred florins.

Nierstein has been already mentioned. Here the soil consists of red decayed slate clay. The site is very good, particularly that portion of it which faces the southern side of Krauzberg, called Klek. This clay soil imparts a high color to the wines much resembling those of the Scharlachsberger, Nakenheim, Bodenheim, Laubenheim, Guntersheim, Petersberg, Ingelheim, Bingen, and their vicinities. The renowned Scharlachsberger grows on reddish slate clay.

Kreuznach. Here the grapes are crushed partly with pounders, and partly in grinding-mills between two revolving rollers. The work is also done in tread-tanks whose bottoms are perfo-

rated with small holes. When the fermentation commences, a tube shaped like a bended leg is fitted into the bung-hole perfectly air-tight, the larger end being inserted therein, and the taper end plunged a few inches deep into a vessel of water. Many people fill these vessels with must instead of water, and every two hours empty their contents into the barrel, for the purpose of adding to the must therein the spirit which has been absorbed by the must in the external vessel. When the rapid effervescence subsides the tubes are removed, and a bung is placed sideways over the vent; and when there is no longer any sound of effervescence emitted, the barrels are filled quite full, and the bung driven in tight. From this period the barrels continue to be replenished every fortnight until the first drawing-off takes place, which is at the end of February or the beginning of March; the barrels are then again refilled, and the operation is repeated at the stated intervals until the time of the second drawing off, which takes place a short time previous to the blossoming of the vines.

All Rheinwines are completely fermented, and are, therefore, a little tart. They are valued especially for the gayety and buoyancy of spirit which they impart by reason of the etherial rapidity with which they pervade the system more than any other wine; and while they exhilarate the frame, they do not molest the head. Age improves them more and more. Of all wines, their good qualities are the most difficult to counterfeit, though a wine very similar to the Rhenish can be manipulated from the French by the following recipe: Three parts sugar, one part cream of tartar, three parts good brandy, to which add of wine lees enough to create a good fermentation.

To make Rheinwine artificially out of sugar or fruit, much acid matter must be added by the use of cream of tartar, or, what is better, tartaric acid. The proportions of these ingredients will be as follows: Of acid, an excess; of saccharine matter, a minimum; and of wine lees, a sufficient quantity to induce thoroughly the fermentative process.

The most certain way of obtaining genuine wines is for the purchasers to pay a visit to the wine countries themselves; when there they will be sure to obtain the most genuine and excellent productions of the respective districts. All the best vintages are chiefly in the hands of owners, who rarely sell a single barrel, but they put their whole crops up at auction, or dispose of them in the gross by private sale to foreign wine-merchants.

The stranger, however, will every where readily find an agent at hand, who knows perfectly well every cellar in the place and its owner, together with his weak points and his private affairs. Through such an agent great bargains can be obtained of the choicest wines at a much cheaper rate and of a purer quality than can ever be procured from foreign wine-merchants. Wine can also be purchased to great advantage of the wine-merchants

themselves in the Rheingau, and the neighboring cities of Mayence and Bingen. Moreover, these dealers have also, in many respects, greater facilities of transport than any negotiator in a foreign country can possibly command, by which it results that they can afford to sell at lower rates and in smaller quantities than any others; which latter is an advantage totally unknown in Rheingau, where sales are effected only at wholesale in entire hogsheads, each of which contains from 1300 to 1400 bottles of Rheingau measure, or 1176 litres.

In Mayence the wine measure is as follows, viz.: the ohm contains 20 quarters; the barrel, 8 ohms, or 160 quarters; the ohm, 180 Frankfort bottles. The measure contains 94 cubic inches French; 100 measures=160½ Berlin quarts. The ohm contains 140, the barrel 1050 litres, French measure.

IV.

FRANCONIAN WINES.

The Franconian wines in Bavaria, especially those of Werthheim, Würzburg, Kitzingen, Marktbreit, Marksteft, and Ochsenfurt, are similar to the Rhine wines, but of lighter and poorer quality, less acid, and in some respects more wholesome. The best kind of this wine is that styled "Leistenwine;" so named from a place on Frauenberg, near Würzburg, and it is grown on a plot of about sixty morgens. This wine, when of a certain age, is superior to the other German wines, and perhaps to all other kinds, from its more pleasant flavor, its spirit, bouquet, and its salubrious qualities. Next in order is the "Steinwine," which is raised in Steinberg, near Würzburg, on a plot of about 490 morgens. It is more fiery than the former kind, but is never so palatable nor so fine flavored, being often of a hot and alcoholic nature. There is a third sort of this wine, called the Calmuth. It derives its name from a mountain ridge which lies between Lengfurth and Homberg, belonging chiefly to the Duke of Löwenstein-Wertheim. The Schalsberger wine is also much appreciated.

The Würzburger and Werthheimer wines are the two principal kinds of Franconian wine which are known extensively in commerce.

The Würzburger is generally raised near Würzburg, Kitzingen, Marksteft, Marktbreit, etc. It is a light wine, of a yellow color, and of a poorer quality than the Rhine wine, possessing greater acidity, and is therefore not so pleasant to the taste, and is even inferior to the Werthheimer. When the wine is intended for the Saxony market it is generally colored of a darker hue than natural by means of burnt sugar.

The Werthheimer wine is raised on the mountain sides on the right shore of the River Main. The vineyards commence at the village of Urphär, and extend to Hasloch. Next to the Stein, Leisten, and the Calmuth wines, this sort is considered the best of the Franconian wines. The most superior in quality are raised opposite to the cities of Werthheim, Remberg, Kaffelstein, and Wetterburg. These regions lie entirely open to the sun from his rising to his setting, and the soil itself is of the very best of its kind, called *Leber-erde* ("Liver-earth"). The plantations are generally set out with "white grapes," and the vines of the finest species, like their kindred sorts of the Riesling, Œsterreicher, and Elblinger.

Of all the Franconia wines, the Werthheimer most resembles genuine Rhine wine; in flavor they are alike, and, if not so fiery, yet they are somewhat sweeter and more palatable. Many prefer this wine, as more wholesome than the Rhine wine; and it is resorted to medicinally in hemorrhoidal affections.

On account of the eminent qualities of these wines, we will divide them into three classes, viz.: 1. The Remberger and Wetterburger; 2. The Kaffelsteiner ou Sand; 3. The Haslocher. The last-named is more pleasant to drink than either of the others, because it sooner attains its maturity in the barrel, but the two former are preferable for long keeping.

The Werthheimer wines, on account of the rich soil, are heavy, and their essential qualities become developed only in the course of six or eight years; therefore they are drawn off three times during the first year: first, in Carnival time; secondly, near St. John's day; and, thirdly, in autumn. In the second year they are only drawn off twice, and in the third and fourth years only once; which depends upon whether the wine is the produce of a good season or a middling one, and whether it is raised in a richer or poorer soil. If kept in good cellars and good barrels, the old wines can be preserved a long time without being drawn off; but the barrels must be refilled regularly. Like the Rhine wines, they are improved by age. A genuine Werthheimer wine is readily distinguished by its richness, and its glow in the mouth without biting the tongue; by its pleasant bouquet; and by the circumstance that, if it be drank in excess, it will not sour the stomach.

Klingberg ou Main, about six hours below Werthheimer, exports good dinner-wines, especially in a favorable season, which may also be said of the wines of Grosshenbach.

The process of wine-making in Franconia is as follows:

The grapes are selected where it is necessary; then pounded with a pronged stick; then the whole mass is thrown into a wire-sieve, so that, by riddling, the juice and berries may be sifted through, and the stalks remain behind; then water is poured upon the strained pulp, and, after standing for twenty-four hours,

it is well pressed. This produces a wine of light quality, called *Laner*, or "drinking wine." The process of fermentation is rather retarded than hurried on, because by slow fermentation better wine is produced. In order to effect this object, the barrels for containing the must are twice fumigated with brimstone, or charred with burning alcohol.

In general, the crushed berries are put into a vat and covered with an oaken lid. The mash is stirred up four times a day, and the crust pushed down into the wort. After the first fermentation is over the clear liquor is drawn off, and the residuum in the vat is again put through the press; and the whole, being intermingled, is poured into the barrels already prepared by brimstone or alcohol. The vent is then closed with a bung long enough to be plunged into the wine, which is perforated with two holes of about a finger's thickness: these are fitted with two corks. As long as the fermentation is active one of these vents remains open, and after it has ceased both apertures are closed with the cork-spiles. Every fortnight each barrel is refilled through one of these apertures, which is again closed, and the other is left open so that the gas can escape. The refilling is done every fortnight for three years.

If the wines are warmly housed in the vaults they are drawn off in May for the first time, and again on St. Bartholomew's day; but if they are in a cold atmosphere, the first drawing-off is deferred to the latter end of September, and the second till the end of November. Should fermentation ensue when the roses are in bloom, then one of the small spile-holes is opened. In the first year the barrel into which the wine is to be drawn must be previously burned out with half an ounce of brimstone, and one eighth of an ounce is to be burned on the surface of the wine. This is also done to the wine which is made from the lees, if they are in good condition. During the second and third years the wine is drawn off twice, and only half the quantity of brimstone is used. In the fourth year the barrels are filled up every fourth week; and if the liquor is to be sold, the stock of it is clarified and drawn off. If, however, it is not intended to be brought to market, it is not necessary to clarify it.

A light, drinkable wine can readily be made by separating the must which runs off first, and pouring it into a barrel which has been burned out the day before with half an ounce of brimstone lighted at the bung-hole. In about twenty-four or thirty-six hours afterward it is drawn off into another barrel, which has been burned out with spirit of wine, during which time a considerable portion of the lees have settled. In cold weather hot must should be added, and the barrel bunged up as above described.

In the middle of December have ready a barrel burned out with half an ounce of sulphur, and draw off the new wine into it. Clarify it in January with a quarter of an ounce of isinglass; and

in eight days after, burn one eighth of an ounce of sulphur in the vacuum caused by first drawing off some few gallons to make an empty place for the sulphur fumes. Then draw off again into another barrel, inside of which a quarter of an ounce of brimstone has been burned. Repeat this for a third time shortly before the roses are in bloom, and again for a fourth time at Bartholomew, using a less and less quantity of sulphur each time. During fermentation in the summer-time one of the small spile holes is to be left open. If the wine after September is pretty clear, then the refilling of the barrels is only necessary once a fortnight.

V.

OTHER GERMAN WINES.

THE Affenthaler wine, from Affenthal, near Bühl, in Baden, is a thick, strong, and much-prized red wine. The Ahr wine, from Ahr, in Rhenish Prussia, is red, or of a reddish color. It is a light, pleasant wine, and fit for use when six months old, but it will not keep over three or four years. From Wallporzheim and Bodendorf they export the best kinds.

Bacharacher wines—both white and red Rhine wines—are somewhat sweet and racy, and highly esteemed.

Bohemian wines, both white and red, are generally of a light quality. The red Melniker is the best sort; next the Aussiger, and a few others from Lentmerizer and Bunzlauer districts. Throughout all Bohemia are only raised 26,000 casks of about fourteen gallons.

Grünberger, from Grünberg, in Silesia. The exports here amount to from 20,000 to 30,000 casks. Both the white and red wines are of inferior quality, and sell for eight thalers per cask of fourteen gallons.

Harrdt wines, from Rhenish Bavaria and the Palatinate. This is the name given to the wines which are made on the Harrdt Mountains. Nearly all of them are white wines, pleasant to the palate, but not equal to the better kinds of Rhine wine.

Rhenish Bavaria contains 33,048 morgens of vineyard plantation, and exports annually from 70,000 to 80,000 fuders (the fuder is about seventeen gallons) of wine, the most preferable of which are worthy of note.

VI.

ITALIAN WINES.

These wines are mostly used for home consumption. Having a very imperfect preparation, they will bear neither transportation nor long keeping. Upper Italy produces a considerable quantity, but exports only a few pipes. Such is also the case with the Romagna and Naples. Sicily exports yearly some 25,000 barrels (somma), worth $75,000. Savoy produces 200,000 hectolitres (about 4,760,000 gallons), mostly for home consumption. Nizza produces 68,640 hectolitres, and Piedmont 1,400,000 hectolitres, which remain in the country, becoming vinegar if kept over a year. Parma, Prazenza, 445,000 hectolitres. Tuscany, 1,257,000 hectolitres. Elba, 85,000 hectolitres. Sardinia exports some wine.

The Italians let their vines run up on mulberry and elm trees, where the shade prevents a perfect ripening, to the great injury of their wines, which, though sweet when new, sour to vinegar in a short time. The best kinds of grapes grow at Albano, eight hours' ride from Rome, with the exception of "Lacrima Christi" (the tear of Christ), the best wine of Italy.

Brescia. The wines from Riviera and the so-called Toscolano are light and agreeable to the taste. In the Upper Riviera the vines are trained upon olive-trees; in Lower Riviera on fences six feet high.

Chambery has very good red wines, the best in Savoy.

Elba. This island furnishes two distinguished wines: Aleatico, made of boiled must, rum, and wormwood, and Muscat. Both are white wines. All the others are very inferior kinds.

Falerno is a Neapolitan wine, high red, thick, and somewhat sweet, but fiery.

Genoa exports some red wine of a middle quality, mostly from Tortosa, Novi, and Voghera. One barilla contains $74\frac{22}{100}$ litres (French measure). One mezzarolla two barillas.

Griante, on the Lake of Como, has a light but savory wine.

The Lipari Islands produce, besides many raisins which are exported, the so-called *Malvasie*, an amber-colored wine, savory, and leaving in the mouth a sweet after-taste. The choicest grapes are selected, and left spread in the sun from eight to ten days before being pressed. But there are only some two thousand barrels produced. The other kinds, although of a less noble quality, are nevertheless not devoid of spirit, are of a pleasing taste, and bear keeping for years. Though some keep the must in tarred skins, the wine loses after a while, in the barrels, the smell contracted from the skins.

Milan has, on Lake Como, at Belaggio and Brianza, pretty

good wines; around Pavia but poor ones, with the exception of an effervescent wine resembling, in a measure, the Champagne. All the produce of Milan is not quite adequate for home consumption. The *quartero* contains nearly six litres, the *mina* two quarteros, the *stare* four, and the *barilla* twelve.

Marsala, in Western Sicily, produces a similar, but inferior wine to that of Madeira, and exports a great deal to America under the name of Madeira.

Modena produces very dark wines, tolerably good, but poor in spirits. The best of this kind is produced at Rubina and Sapolo.

In Tuscany, the Monte Pulciano is a strong, spirituous, red wine.

The wines of Naples are mostly sweet. On the Mount Vesuvius three kinds of wine are made: 1. Lacrima Christi—the best sweet wine of this country—of a fine red color, and of an excellent taste and bouquet. Very little of it is made, and this goes mostly into the cellars of the king; therefore that in trade is mostly spurious. 2. Muscat, of an amber color, with a fine taste and bouquet. 3. Greek, a kind of Malvasie. Puzzuolo and Baja have white and red sweet wines, which often sell for Malvasie.

Calabria produces good Muscat wines, mostly at Carigliano and the environs of Tarento. The wine-measure is the barilla of forty-two and a half litres; twelve barillas make one *botta*, or about one hundred and twenty-two and a half gallons; two bottas, one *caveo*.

Piedmont produces keen, but sweet and dark-colored red wines, which mostly sour in August or September, turn next year into vinegar. But some wines form an exception to this general rule, where more careful wine-growers observe a judicious procedure. The best wines are made in Asti and Chaumont. Alba has also some good, but not strong wines. Gatinara, Masserano, and the red wines of Biella keep better. Montferrat has distinguished white and red wines, mostly those of Casal, fifteen leagues east of Turin. There the *rubo* has about two gallons, the *brenta* six rubos, and the *carro* (a wagon-load) ten brentas.

Puzzuolo, a village in Naples, raises red wines similar in taste to the inferior qualities of Bordeaux; but it bears transportation by sea, and finds ready markets in Holland, Hamburg, America, etc.

In the Romagna, the grape-vines are trained upon elm-trees; and, for this reason, they do not ripen always; and, by careless preparation, the wines are bad, and keep rarely over a few months. The wines from Albano and Orvieto are exceptions. The latter place produces a tenable red wine, and a white Muscat with a good bouquet and a balsamic perfume, but of not long keeping. Farnese and Terni have also some good wines. At Rome, the barilla has about eleven gallons English, and the botta sixteen barillas.

Sardinia sends her wines mostly by Cagliari. She has Malva-

sie of Sorso, Posa, Alghiera, Rasco, amber-colored, with a fine bouquet; Giro, sweet, but not spirituous, somewhat resembling the Tinto of Alicante. The wines of Bosa, Saffari, and Ogliastra are dark red, and pretty strong; as a general rule, they are more like the wines of Spain than those of France. Cannoao, Monaco, and Garnaccia send their wines, under the name of Malvasie, to Holland, and other northern places. The best wines are kept in earthen vessels, containing about five or six gallons English.

Sicily keeps her common wines, but sends some of her sweet ones abroad. Syracuse supplies good red and white wines, of sweet, aromatic taste. The first is pale red, and the white one amber-colored. Mascoli and Mazara have quite good red wines; Catanea has strong ones of a tarry taste, which are consumed mostly at home. The wines of Sicily are of a first-rate odor and good taste, but are from the beginning badly managed, and therefore do not keep long. The grapes begin to ripen in June, and the vintage commences in September. One thousand vines give from one and a quarter to four pipes of wine. There are cultivated for wine-making only nineteen species of grapes, of which the best are the Cibibbo, Carmola, Greek Muscat—the dry and the winter grape. In the Lipari Islands the vines are kept high, as in Sicily; they cut the clusters at the end of August, keep the grapes spread in the sun for from six to eight days, sprinkle them over with ley to neutralize the acidity, and then pack the dry raisins for exportation.

Tuscany has, in general, the best Italian wines. The red ones are somewhat thick and dark, and resemble the Bordeaux wines of inferior quality; but the white ones are dainty and aromatic. One of the best sorts is the Aleatico, which is sweet, well colored, and has a good bouquet. It is exported in small bottles via Florence. They make also Aleatico in the island of Elba and in the Roman District. In the environs of Sienna, at Monte Pulciano, and other places, good sweet wines are manufactured, and exported from Florence in bottles of about one quart each. The *barilla* contains about from nine to ten gallons. The fiascone, in Florence, about two and a half quarts.

Fabrioni describes in his work, "Arte di fare il Vino," the method used for making the red and dark wines of Tuscany, as the Carmignano and Monte Pulciano; and the white ones, viz., the Trebiano, Topazio, and Malvaglia. The Carmignano is raised on the hills of Carmignano; the vintage is from the last days of September to the 10th of October. A few days previous the grapes are spread on mattings and often turned, to get some dry grapes (raisins). The other ones are bruised, and worked well every twelve hours in the seven first days, with forks or the feet. In about a fortnight the fermentation ceases, and the husks and stems are only from time to time pressed down. After the lapse of twenty days the vats are covered, and when the wine becomes

clear it is decanted into barrels, to which, for each barrel, a certain quantity of the above dried grapes, well smashed, is added, and well mixed with the mass. A new fermentation then takes place, which commonly lasts from six to eight days. In Monte Pulciano (considered by them the king of wines), the vintage is retarded as long as the weather will admit; then one tenth part of the must is condensed by boiling and mixed with the other. Trebiano makes her white wine from white grapes. This is of superior quality. They draw the fluid mass from the husks as soon as the fermentation commences; then again, in about fifteen days, from the dregs (settlings); in a month later a third time. The Topazio takes its name from the color resembling a topaz; it is made in the same way as the Trebiano. The Malvaglia is pressed from grapes which are soon made dry by twirling their green stems; the must is then heated to nearly the boiling point. Toscolano has light but well-colored wines of an agreeable taste, which keep well for twenty-five years. At Brescia the measure *zerla* contains about thirteen gallons of ours, and twelve to fifteen zerlas make one *caro*.

Vino Santo (Holy wine) is a sweet wine from Castiglione and Lonato, five leagues from Brescia. It is a golden-yellow wine, sweet, mild, and of good flavor generally, if three or four years old. This wine is made from well-assorted grapes, which are spread on scaffolds, and kept there as long as December. They compare it with the Tokay, and prefer it to the wines from Cyprus. Piacenza exports, under the name of Vino Santo, a mixture of several species to Milan and Genoa.

The wines of Vicentia are less spirituous than those of Friuli; but they are recommended to sufferers from the gout. In Vicenza and Padua the grape-vines are raised on walnut-trees, which impart an odor and taste to them not suited to every palate.

Zara, though not renowned for more than middling quality of wines, has distinguished brandies and wine vinegars.

VII.

SPANISH WINES.

Spain has several wines of the choicest kind, and exports a great deal. The greatest marts are Alicante, Malaga, and Xeres. Malaga raises annually some 80,000 "arobas" (about 350,200 gallons), of which more than one half is exported. Catalonia furnishes annually about 600,000 pipes (of 425 litres), or about 63,600,000 gallons; Valencia, 3,000,000 *cantaros* (36,000,000 gallons), and some 6,000,000 pounds of raisins.

The Spanish wines are nearly all made of thoroughly ripe

grapes and condensed must. They have caldrons holding nearly one thousand gallons. They boil the must until three quarters of it has evaporated, skimming off the froth when it rises. This sirup is then added to the unboiled must in different proportions, according as more or less sweet and strong wines are required. For the white wines no sirup is used; but more or less brandy is added, which prevents an entire fermentation, and consequently these wines retain some sweetness.

Andalusia produces several exquisite wines, which she exports *via* Cadiz, Rota, and Santa Maria. The choicest ones are the following:

At Rota the best red wine of Andalusia is made. When new it is dark red, but loses color by age. The Spaniards call it, therefore, *Tintilla*, or *Tinto de Rosa*. It is a sweet wine of much fire, elegant taste, and aromatic bouquet. It shows some similarity with the Alicante, without its astringent property. Its color, nevertheless, is darker, and its taste sweeter, improving rather than losing by age.

Xeres de la Frontera, seven leagues from Cadiz, has three sorts of spicy white wines, viz., Paraxete, sweet, of agreeable taste, and odorous; Vino Seco, dry and bitter, but, nevertheless, good-tasting and aromatic; and Abocado, holding a middle position between the two former. They make also "Pedro Ximes" wine, which some persons prefer to Malaga, and also Muscat—pretty good, but inferior to that of St. Lucar. Among their red wines they have also some Tintilla, but not of so good a quality as that of Rota. Xeres produces yearly 360,000 *arobas* (about 1,440,000 gallons), of which 200,000 are exported to England and France. In England an artificial sherry is manufactured out of Cape wine, to which some extract of bitter almonds is added.

The monastery of Paraxete, one and a half leagues from Xeres, furnishes also the above-named three kinds of white wine, and of still better quality than that of Xeres, which bring also higher prices.

Moguro has also some reddish wine of good quality, and much of inferior quality is exported to the colonies.

St. Lucar de Barameda has red and white wines, which gain by age, and are mixed in Xeres with others.

Negro Rancio is the name of a very dark wine, of a dry, pasty nature, more keen and prickling than sweet. It is a great deal in demand for mixing with other wines which are deficient in these qualities. They make the same in Rota, Xeres, and some other places.

Seville produces a great deal of wine from must, of which a part is condensed by boiling. This is very dark, but without bouquet.

The *aroba* contains in Andalusia $15\frac{74}{100}$ litres, not quite four gallons; and the *botta* 28 arobas.

Aragon produces much dark-colored tasteful red wines, which

would be more valuable if the grapes were not in so many instances planted on a too rich soil. Exquisite are the "Grenache" from Sabayes and Carignena—reddish, sweet, of an agreeable flavor, with a good deal of spirit; and a white sweet wine from Borja. Saragossa is the chief market-place. The *cantaro* contains about two gallons and one and a half quarts; a *nietro* or *carga* about 38 gallons.

Biscay has very poor wines, mostly green, tart, and sour, which do not bear keeping. The only exception is a wine from the environs of Vittoria, called Pedro Ximenez.

Estremadura furnishes, besides some good wine, Tinto, which, nevertheless, has little similarity with that of this name from Alicante. It is a mild wine, has a good color and spirit, a fine taste, and agreeable bouquet. It is the only Spanish wine which will bear comparison with the best French wines of the second class.

Gallicia produces very little. The best of her wines come from Ribadavia and Tuy. Of both some is exported. The common measure is named *cantaro*, holding $16\frac{79}{100}$ litres—about four gallons three quarts.

Grenada has only two distinguished places for good wines: the territory of the city of Malaga, and Velez Malaga, five leagues from Malaga. Upon the mountains around the former city grow the grapes which give those exquisite wines known in France and Germany under the name of Malaga, in England under that of Mountain wine. They distinguish seven varieties of it: 1. Pedro Ximenez—sweet, delicious, with a great deal of bouquet, but inferior to that from Xeres. 2. Vino Tintorio—when young, dark amber-colored and very sweet; with age it loses some of its sweetness, and becomes more spirituous and aromatic. This is the kind that comes, under the name of Malaga, to the various countries. It bears keeping over one hundred years. Its price increases with its age; and while the *botta* (440 litres) of a new wine sells for 150 francs, the *botta* of the oldest one will bring 5000 francs and more. 3. Muscat; of which there are two kinds, Malaga Muscat and Drop or Tear Muscat. These have a yellowish color and much bouquet, especially the latter, which is also clearer and finer. 4. Cherry, made of common wine with which sour cherries are macerated, the taste of which the wine adopts. 5. The dry white wine, near in quality to the Sherries, and sold under that name. 6. Malvasie, similar to that of Sihes, which will, however, keep but a very short time. 7. Tinto, of a dark color, sweet and keen.

Velez Malaga, five leagues east of Malaga, furnishes also a great deal of wine, which is sold for genuine Malaga, although of a little inferior quality. The main product of Velez is raisins.

Minorca produces, in the environs of Aleyor, a very good dark red wine, of excellent taste, which nevertheless does not bear exportation, losing its good qualities in a few days by a sea voyage.

Alba Flora, a white wine, fine, spirituous, and of a good bouquet and taste, is also of some repute.

Catalonia has mostly red wines, little tenable, losing in a short time their color and taste.

Majorca produces, near Pallenzia, a valuable kind of Malvasie.

Murcia furnishes only thick and tart wines, though those of Carthagena attain sometimes the quality of inferior Alicante.

Navarre exports but small quantites. Around Tudela, sixteen leagues from Pampeluna, they make pretty good wines, approaching inferior qualities of Burgundy. Near Peralto, two valuable wines are produced: the Rancio, similar to the Paraxete, and a sweet wine, delicious and spirituous. The staple place for these wines is Pampeluna.

New Castile has wines in La Mancha and Valdagenas, which are less colored and less strong, but have nevertheless a more agreeable taste than most of the other Spanish wines. The better ones are compared with the middle wines of Burgundy. They have fineness, spirit, and even some bouquet. In the second class we may count those of Manzanares, Albacete, and Ciudad Real, though most of them are sent to Madrid in skins, from which they contract an odor and strange taste. Fuencarol, near Madrid, has a celebrated Muscat wine, sweet, of good taste and bouquet.

In Valencia, the vineyards are partly on hills and partly in the valleys; therefore they differ in quality. The grapes on the plains are mostly made into brandy, of which from 500,000 to 600,000 *cantaros* are distilled. Alicante, thirty leagues from Valencia, produces the celebrated Tinto. This wine bears long keeping, with a continual improving; is very tonic, and therefore much valued for a stomach-invigorating beverage. It is of a dark red color, which in course of time covers the bottles with a layer. It is very sweet, warming, of an agreeable bouquet and taste. They also make here a pretty good sweet white wine. Benicarlo, twenty leagues from Valencia, and Vineroz, produce dark red wines of first quality, preferable to the common Alicante. The *cantaro* contains 10¾ quarts, the botta from 103 to 117 gallons.

VIII.

PORTUGUESE WINES.

Portugal has an important vine-culture, producing mostly red wines, and exports yearly over 100,000 pipes. The prominent staple place is Oporto, with an exportation of about 80,000 pipes, the pipe worth from sixty to eighty dollars. The wines of Portugal are inferior to those of Spain, being of less strength, and requiring, therefore, an addition of alcohol to enable them to keep and bear a sea-voyage.

Of white wines, those of Carcavellos are nearly alone exported, under the name of Lisbony. This is sweet, spirituous, and of a good bouquet. Next to it is that of Setuval, which place produces a sweet and a common wine, both of a good quality.

Bucellas, six leagues from Lisbon, has white wines which, to enable them to bear keeping, are mixed with alcohol.

Oporto has Vinos de Fectoria and Vinos de Ramo. The former are the better ones; but, in order to enable them to keep or stand a sea-voyage, one twelfth part of brandy is added after the first fermentation is over. This is the kind which is exported under the name of Port wine. Pego de Regua furnishes the best Vino de Fectoria. The *pipa* (pipe) holds about 104 gallons. The wine district of the Upper Duoro commences about fifty miles from the harbor of Oporto, and consists of a range of hills on both shores of the river, well exposed to the sun, and consisting of a loose soil peculiarly adapted to the growth of the grape-vine; but the best ones grow where the upper stratas consist of weather-beaten clay slate, as in the case of the district of Axarquia, which, under the surveillance of a privileged company, not only limits the price of the different kinds of wine, but also prescribes within what boundaries the vines are to be planted.

IX.

MADEIRA WINES.

Madeira, to which the vine was transplanted in 1421 from Candia, produced formerly some 30,000 pipes; but at present only about 20,000 pipes of common wines and about 500 pipes of Malvasie, of which about the half goes to England, North America, and the West Indies; the balance is consumed on the island itself. The vines are mostly planted upon sandy and stony soil; and some vine-trunks can be seen there which the extended arms of three men are unable to compass. They have three kinds of wine: 1. Malvasie; 2. Dry white; and 3. Tinto.

The Madeira Malvasie, from the variety of Candian grapes, is the most exquisite sort of Malvasie, sweet, very delicious, and full of a balsamic fragrance. It occupies a prominent place among the first-class wines. It becomes with age more pleasing, and sells, at the place of its growth, for $200 per pipe; but, in order to enable it to hold out a sea-voyage, alcohol or brandy must be added.

The Dry Madeira, or *Madère sec*, is still more dry than the white Burgundy, though without having the piquantness of the Rhine wines. This is amber-colored, spirituous, aromatic, and often of a walnut taste.

The Red Madeira (Tinto) has a great deal of astringent matter, and can not be used alone without injury to the health.

In the interior of this island they raise the vines on trees, under the shade of which the grapes attain so little of maturity that they must be subjected to a crushing process in order to press out the juice; but this, of course, gives only a watery, poor wine, that does not bear keeping.

The Dry or Harsh Madeira is often mixed with the Tinto, and thus exported. It improves by passing the equator; and Englishmen ship it and re-ship it for this purpose to the East Indies and back. But now the same result is attained in Madeira by keeping such wines in heated rooms, where they will become, in a few months, as good as if kept in a cellar for five or six years. They have had in Madeira, for some fifty years, such apartments, of enormous sizes, heated with large stoves and heat-conducting tubes, filled with barrels and hogsheads, for the above purpose.

X.

CAPE WINES.

The Cape of Good Hope produces three sorts of wine, which are commonly designated Cape Wines. The most celebrated is the Constancia, so called from a mountain of the same name two leagues from the promontory. It may be classed among the first quality wines, second only to the Tokay. This is sweet, spirituous, very agreeable in taste, and exquisitely spicy. The white one is a little less sweet than the red one. In former years only some 900 hectolitres, or about 22,950 gallons, have been produced, which was sold at the place of its growth for 80 and 120 cents the bottle, while the common one is sold for one cent. The grapes are left on the vines till they become shriveled. After the Constancia follows, in quality, the Muscat, which is grown on the False and Table Bay. In Europe it sells under the name of Constancia, notwithstanding its inferior merit. The best kinds of this wine are those of Beker and Hendrik. The third sort of Cape wine is the Stone wine; though dry, it has a good taste. It is raised in the districts of Gerlen, Drachenstein, and Stellenbosch. The red wines are there known under the name of *Rota:* they are somewhat like the Spanish wine of this name. They are dark, of good body and spirit, and a pleasant odor. Recently the quality of the Cape wine has been impaired, because the winegrowers look more for quantity than for quality. In 1806, only 6909 pipes were exported; while in 1817 there were 12,000 pipes, and in 1822, 23,000; and since then a constantly increasing amount has been sent abroad.

XI.

GREEK WINES.

THE islands in the Mediterranean are eminently fit, on account of their dry and sunny hills, for the cultivation of grapes; and if the wine-making were more skillfully attended to, most excellent sorts could be produced.

Candia has strong, but few wines. In former times the culture of vines was of much more importance than toward the end of the sixteenth century. Candia exported annually to Italy about 200,000 barrels.

Cyprus, Samos, Scio, and Tenedos produce yearly 600,000 ocas, or about 220,000 gallons; and Santorin 1,000,000 ocas, or 375,000 gallons. Miconi and other isles of Greece export, also, some wines.

The Ionian Islands produce good wines, which are sent to Italy, Trieste, etc. Saint Maura exports from 7000 to 8000 *barillas*, 119,000 to 136,000 gallons. Cephalonia 15,000 barillas, 255,000 gallons of red, and 12,000 barillas, 201,000 gallons of white, and 8000 barillas of Moscatello. Corfu exports annually from 200 to 300 loads, and Zante 4000 barillas, 59,500 gallons. Thiaki, formerly Ithaca, exports yearly 375,000 pounds of raisins.

The continent of Greece—the modern kingdom—has exquisite situations for vine culture, but hitherto little wine has been produced, and this badly attended to. The greater part is produced in the Morea. Patras, the Monastery of Megaspilon, and Pyrgos produce some 100,000 barillas, 1,700,000 gallons; Shiron, Argos, Megara, Arcadia, and Tripolizza, 15,000 barillas, 255,000 gallons. Mesenten and Laconia have Malvasie.

XII.

GRAPE CULTURE IN TURKEY, PERSIA, CHINA, ETC.

VINE culture in Turkey is not of much consequence, because the Mohammedan religion does not allow the drinking of wine; but for the Jewish, Greek, and Armenian inhabitants, in some places wines are produced. In Moldavia, between Cotnar and the Danube, a very good white and red wine is made, and some of it is exported to Russia. The best one has a greenish color, which becomes brighter by age; the wine also improving, being, after the lapse of three years, as strong as brandy. But it is often drawn from its settlings, which would otherwise improve its strength. From Wallachia some goes to Russia and Poland. The

wines of Piatra have a slight similarity to the Tokay. Bosnia, Servia, Turkish Dalmatia, and Bulgaria do not export any.

The wines of Asiatic Turkey are but little known in Europe. Anatolia has some export, especially of Mondania, a pretty good white wine. Syria exports more; and her wines are somewhat similar to those of Bordeaux. The best one is from Libanon, named the *Gold Wine.* They make there, also, wine from must, condensed by boiling. Palestine herself produces not a great deal of wine, but the environs of Jerusalem give a good white wine. In Mesopotamia the wines of Bajazet are the best. In Arabia the grapes are raised more for raisins than for wine.

Throughout the whole of Persia the grape-vine is cultivated. Notwithstanding that most of her inhabitants profess the religion of Mohammed, they drink wines in secret, as they formerly did publicly. They raise from ten to fourteen kinds of grapes—white, blue, black, and red. The most distinguished of them is a white variety, with pretty large berries, of a sweet and agreeable taste, like our Muscats. In Ispahan the vines are trained upon trellises, and bear profusely—about ten times as much as those treated in the common way. Being a country of a warm climate, the grapes are ripe and gathered toward the end of August. In the region of Shiraz a great deal of wine is produced, especially the renowned Shiraz, made from a red grape. Besides this latter, there is still another distinguished grape, called Rischbaba, which has no seeds, and its berries are large, white, very sweet, and of a fine taste. The wines of Shiraz are partly made of must, previously condensed by boiling, and partly of half-dry grapes. In Erivan tradition has it that Noah planted his first vines.

In China the grape culture was much in vogue nineteen centuries ago, and the provinces of Chausi, Chensi, Petchely, Chantong, Honan, and Hougnana, then produced plenty of wine. But at present these people prefer their tea, and a warm beverage, made like our beer, but from rice instead of barley. The grapes raised at Honan, Chantong, and Chansi are now made into raisins of superior quality.

The district of Hanir, northwest from China, exports very fine and sweet raisins.

In Japan grape-vines are abundant, but no wine is made from them.

In the East Indies vine culture exists in some places. In the province of Lahore very good wines are made.

In Cochin China wild grapes are common, but they are not used for wine-making.

In Australia recently some satisfactory experiments have been made in cultivating grapes.

XIII.

GRAPE CULTURE IN AFRICA, AMERICA, RUSSIA, AND ENGLAND.

In Africa the culture of the vine is not very extensive. Egypt, in the times of the Romans, furnished excellent wines, but at present only few. The same is the case with Abyssinia.

In the Barbary States vines are found in some places. At the southern extremity of Africa is the Cape of Good Hope, of the wines of which we have already spoken.

The Cape de Verd Islands export no wines. The Canary Islands produce a large quantity. Teneriffe produces yearly 40,000 pipes, or about 4,400,000 gallons. They make from grapes transplanted from the Morea a kind of Malvasie wine, of agreeable taste, sweet and spirituous; and *Vidogne*, which, though keen and tart when new, gains by age. The wines of the Palma Island, though inferior to those of Teneriffe, are more tasty. Madeira has been already mentioned.

Of the Azores, St. Michael produces about 5000 pipes, and Pico from 15,000 to 30,000. Both are pretty good wines. Fayal exports much of the same, and of her own growth, which is very good.

In the northern parts of America the wine culture at present is very limited. Canada has one kind of wild grape, which is, nevertheless, made only some use of at Montreal. The United States have also some wild grapes. In the environs of Philadelphia, Cincinnati, and Herman, considerable progress is already made in this line. California produces wines much resembling those of Madeira.*

In Spanish America the grape culture was formerly much limited by the action of the mother country. Mexico exports already from El Paso del Norte quite good wines to the surrounding countries. Peru produces much of it. Those of Lucumba, Pisco, Sucamba, and Arequipa are much valued. The wines of Chili have some similarity with those of Alicante. She exports about 270,000 *arobas* to Buenos Ayres and Paraguay, and some 800 arobas to Peru. Near the city of Moquegna, in South America, a good deal of wine is made. It is mostly like that of Spain. It is somewhat strange that they do not sell the wine by measurement, but by weight. Fifty *libras* of wine (two arobas) cost from eight to nine piastres. These wines are kept in goat-skins. The use of barrels is nearly unknown.

Russia produces wines in her southern provinces. The wine from the Crimea resembles somewhat the Hungarian. The best of it is made about Sudak and Kos; annually about 510,000 gal-

* [This view of the vine culture of the United States was written some years ago. Since that time it has vastly increased.—A. H.]

lons. Astracan has very good wines. The German colonists on the rivers Sarpa and Volga also produce good wines. In some parts of the Caucasus grapes prosper, as they also do in Mingrelia, without cultivation; so that this region resembles an extensive vineyard. The wines are still better than those of the Crimea. In Georgia also grapes grow wild, and the wine made from them keeps not over a year. In Daghestan we find also exquisite grapes. Here they condense the must, and mix it with rose-water. In Derbent the grapes are very sweet, and they give a good light red wine. In Grusia all the hills and mountains are covered with vineyards, the vines sometimes forming hedges, and sometimes climbing up on mulberry, pomegranate, and walnut trees. The wine is not kept over a year. In Shirwan some wine is made, which is the best on the Caucasus.

In England a great deal of wine was formerly made by the monks, but the grapes did not come to maturity every year. Now a little is made by the farmers in Sussex, from grapes which climb upon the walls of the houses; in Derbyshire also some is made; but these are of very inferior quality, and hardly worthy of notice as to quantity.

APPENDIX B.

THE MANUFACTURE AND TREATMENT OF WINES.

EXTRACTED FROM JOHANN CARL LEUCHS' TREATISE ON WINES AND WINE-MAKING (*WEINKUNDE*): NUREMBERG, 1847.

APPENDIX B.

JOHANN CARL LEUCHS ON WINE-MAKING.

I.

FERMENTATION.

In the process of fermentation, carbonic acid is produced by a chemical process which is explained in all books upon chemistry. In the formation of carbonic acid caloric is liberated, and the fermenting liquid becomes heated. The more active the fermentation, the greater is the amount of heat produced. When large quantities of grape-juice are fermented together, care must be taken that it is carried on at a reduced temperature, otherwise the heat would become too great. The general rule is, that if a vessel containing five hectolitres requires from 25° to 28°, one containing ten hectolitres requires from 15° to 20°, and one containing thirty or more hectolitres requires from 12° to 15°.* The heat of fermentation appears to be mainly produced by the formation of the carbonic acid, as it is in ordinary combustion, in which this gas is likewise developed and heat produced. In fermentation, however, the increase of temperature is not so perceptible as in combustion, for the process goes on but slowly, and the heat developed is dispersed by radiation and conduction; and, moreover, a considerable part of the heat becomes latent by the evaporation of the water contained in the juice. When large quantities of juice are fermented together, the increase of temperature, however, becomes quite perceptible. It decreases as the fermentation lessens, and also when the larger part of the sugar is decomposed. It has been calculated that, in the fermentation of a mash of malt

* The degrees of temperature given here, as elsewhere in this treatise, are those of Reaumur, whose thermometer is generally used in Germany. These may be converted into their equivalents of Fahrenheit and Celsius by the table on page 196.

liquor, when the highest degree of heat has been attained about nine tenths of the sugar has been decomposed.

When the sugar has been decomposed, or the fermentation begins to subside on account of the lack of yeast or its inefficiency, the formation of *air-bubbles decreases*, as less sugar becomes resolved into carbonic acid and alcohol. These bubbles, which had formed a kind of foam upon the surface, gradually disappear by bursting, and are replaced by few new ones. The *falling of the foam* now begins by the formation of air-holes and rents; and also the *bursting of the surface*, as the solid parts, which had hitherto been kept floating by the foam, now follow the law of gravity, and sink back into the fluid. At the same time the *decrease of heat* begins, as a natural consequence of the lessened development of carbonic acid. The *cessation of the inner commotion* soon follows; in consequence of which, the heavy parts of the liquid are precipitated to the bottom, while the lighter ones swim on the surface. These latter consist mainly of the yeast, a part of which had been used up in the fermentation, while a part had been formed during the process from the gum and vegetable albumen contained in the juice.

The result of these various processes is the *clearing of the fluid*, especially of the middle portion of it. This clearing may be considered as a sure proof that the fermentation of the must has been properly conducted.

Meanwhile only a part of the sugar has been decomposed, and only a part of the yeast, or the glutinous substances which may form yeast, even if these have been separated from the portions which have been precipitated, or which still swim on the surface. The fermentation, therefore, still continues; the yeast and gum yet present, combining with the air, go on converting the remaining sugar into alcohol and carbonic acid until all the sugar is consumed.

This fermentation is called the *After Fermentation.* It goes on very slowly, frequently requiring years to complete it if the wine is kept in close vessels in a cool place. It may be known by the wine becoming richer in alcohol, less sweet, and specifically lighter. If this fermentation is comparatively vigorous, and the cask is air-tight, the wine will effervesce when the cask is opened, or may even burst the vessel if a great amount of carbonic acid has been generated.

If favored by a high temperature, or if the liquid contains a large amount of undecomposed sugar or yeast, this after fermentation may present more or less of the characteristics of the first fermentation. This is generally prevented by clearing it off, cooling, sulphurization, etc.

If the yeasty parts remain in the liquid, the fermentation shows itself in a different way. The yeast, settling down to the bottom, decomposes the saccharine parts near it, together with the alcohol. Air-bubbles then rise, indicating the commencement of

the acetous fermentation. The liquid begins to effervesce, floculent particles swim about in it, heat is generated, oxygen is attracted from the atmosphere, and the fluid is changed into vinegar.

II.

IMPLEMENTS USED IN WINE-MAKING.

The principal implements used in the manufacture of wine are the *Thermometer* and the *Areometer.* The former is used to measure the temperature during fermentation; the latter to measure the saccharine matter of the must and the alcohol of the wine. Besides these, there are other implements used to ascertain the acids and the quantity of carbonic acid forming.

The Thermometer.

The thermometer is used to measure the variations of temperature. The principle upon which it is constructed is that matter expands, or increases its volume, when heated, and contracts when cooled. Thus a given quantity of mercury occupies more space when warm than when cold. For many reasons, it is found convenient to use mercury for the construction of thermometers for common purposes; though for scientific purposes, where extreme accuracy is required, other substances are employed. The mercurial thermometer, however, is sufficiently accurate for the purpose for which it is required in wine-making. There are three kinds of mercurial thermometers used in different parts of the civilized world. The principle of all is the same. They consist of a bulb containing mercury, to which is attached a glass tube with a very small bore. As the mercury in the bulb expands by heat, it rises in the tube, the height to which it reaches at various temperatures being marked on a scale attached to the tube. The only difference between the thermometers in use is the number of degrees by which this expansion is marked on the scale.

In Reaumur's thermometer the point at which water begins to freeze is marked 0; that at which it boils is marked 80; and the intervening space is divided into 80 equal degrees, marked from 0 to 80.

In Celsius's thermometer the freezing point is marked 0, the boiling point 100; the intervening space being divided into 100 degrees, marked from 0 to 100.

In Fahrenheit's thermometer, 0 (or zero) indicates a temperature much below the freezing point of water, which is marked 32, while the boiling point is marked 212. The space between the freezing and boiling points is therefore divided into (212 − 32) 180 parts.

Thus the space between the freezing and boiling points of water is divided by Reaumur into 80 parts, by Celsius into 100, and by Fahrenheit into 180 parts. The following table will enable any one readily to convert the degrees of temperature as marked by one thermometer into those of either of the others.

The degrees below zero in each are indicated by the sign − (*minus*).

COMPARATIVE TABLE OF THE THERMOMETERS OF REAUMUR, CELSIUS, AND FAHRENHEIT.

Reaumur.	Celsius.	Fahrenheit.	Reaumur.	Celsius.	Fahrenheit.	Reaumur.	Celsius.	Fahrenheit.
80	100.00	212.	42	52.50	126.50	4	5.00	41.00
79	98.75	209.75	41	51.25	124.25	3	3.75	38.75
78	97.50	207.50	40	50.00	122.00	2	2.50	36.50
77	96.25	205.25	39	48.75	119.75	1	1.25	34.25
76	95.00	203.00	38	47.50	117.50	0	0.00	32.00
75	93.75	200.75	37	46.25	115.25	− 1	− 1.25	29.75
74	92.50	198.50	36	45.00	113.00	− 2	− 2.50	27.50
73	91.25	196.25	35	43.75	110.75	− 3	− 3.75	25.25
72	90.00	194.00	34	42.50	108.50	− 4	− 5.00	23.00
71	88.75	191.75	33	41.25	106.25	− 5	− 6.25	20.75
70	87.50	189.50	32	40.00	104.00	− 6	− 7.50	18.50
69	86.25	187.25	31	38.75	101.75	− 7	− 8.75	16.25
68	85.00	185.00	30	37.50	99.50	− 8	−10.00	14.00
67	83.75	182.75	29	36.25	97.25	− 9	−11.25	11.75
66	82.50	180.50	28	35.00	95.00	−10	−12.50	9.50
65	81.25	178.25	27	33.75	92.75	−11	−13.75	7.25
64	80.00	176.00	26	32.50	90.50	−12	−15.00	5.00
63	78.75	173.75	25	31.25	88.25	−13	−16.25	2.75
62	77.50	171.50	24	30.00	86.00	−14	−17.50	0.50
61	76.25	169.25	23	28.75	83.75	−15	−18.75	− 1.75
60	75.00	167.00	22	27.50	81.50	−16	−20.00	− 4.00
59	73.75	164.75	21	26.25	79.25	−17	−21.25	− 6.25
58	72.50	162.50	20	25.00	77.00	−18	−22.50	− 8.50
57	71.25	160.25	19	23.75	74.75	−19	−23.75	−10.75
56	70.00	158.00	18	22.50	72.50	−20	−25.00	−13.00
55	68.75	155.75	17	21.25	70.25	−21	−26.25	−15.25
54	67.50	153.50	16	20.00	68.00	−22	−27.50	−17.50
53	66.25	151.25	15	18.75	65.75	−23	−28.75	−19.75
52	65.00	149.00	14	17.50	63.50	−24	−30.00	−22.00
51	63.75	146.75	13	16.25	61.25	−25	−31.25	−24.25
50	62.50	144.50	12	15.00	59.00	−26	−32.50	−26.50
49	61.25	142.25	11	13.75	56.75	−27	−33.75	−28.75
48	60.00	140.00	10	12.50	54.50	−28	−35.00	−31.00
47	58.75	137.75	9	11.25	52.25	−29	−36.25	−33.25
46	57.50	135.50	8	10.00	50.00	−30	−37.50	−35.50
45	56.25	133.25	7	8.75	47.75	−31	−38.75	−37.75
44	55.00	131.00	6	7.50	45.50	−32	−40.00	−40.00
43	53.75	128.75	5	6.25	43.25			

The Areometer, or Must-Scale.

When a solid body is put upon a fluid, it will press it out of its place; and if it be heavier than the fluid, will sink to the bottom; but if it be lighter, it swims upon it. The swimming body itself pushes, however, more or less parts of the fluid out of their place; sinks more or less deep into it. The depth of this sinking is dif-

ferent, according to the nature of the fluid. One that has more particles in the same space will offer more resistance, and consequently allow the body to sink less deeply. For instance, water in which salt or sugar has been dissolved has, of course, more particles than pure water, and will consequently not allow the body to sink so deep into it.

Of this property of matter use has been made to determine the proportion of solid parts in a given fluid, or the quantity of lighter fluids mixed with it. An instrument for this purpose is called an *Areometer*, or, according to its various purposes, a *Hydrometer* (Water-Scale), an *Alcoholometer* (Spirit-Scale), a Must-Scale, a *Saccharometer* (Sugar-Scale), an *Alcalimeter* (Alkali-Scale), etc., etc.

The main parts of such an instrument are, a stem, with a hollow ball at its foot, to make it swim, with a weight beneath, to keep it in a perpendicular position. The stem is divided into equal parts (degrees), and determines by them the weight of the fluid, or its contents of solid or spirit parts. The kinds named after their inventors, Beaume's, Cartier's, Tralles's, Richter's, and those for especial purposes, as for sugar, salt, malt liquor, are the most in use.

Of Beaume's Areometer we have two kinds: one for fluids that are heavier than water, the other for lighter ones. In the former kind, the point at which the stem sinks into pure water is marked by 0, and the one at which it sinks into a solution of 10 parts of salt in 85 parts of water by 15; the intervening space, therefore, is divided into 15 parts, and the entire stem is likewise divided into degrees of similar length. Each degree thus indicates 1 per cent. of salt. In the latter kind, the point at which the stem stands in pure water is marked by 10°; the one at which it stands in a solution of 10 parts of salt in 90 of water by 0; and the entire stem, up to its upper end, is divided into 60 and more equal degrees.

Cartier's areometer differs but little from this latter. It sinks in pure water to 10°; in pure alcohol to 42°. The higher degrees only differ somewhat. For instance, 14° C. are =13.47° B.; 18° C. =17.73° B.; 25° C. =25.2° B.; 30° C. =30.53° B.

Richter's alcoholometer sinks in water to 0; in pure alcohol to 100°. The number of degrees to which it sinks in a fluid composed of water and alcohol indicates how many parts by weight of alcohol of the specific gravity of 0.792 are contained in 100 parts by weight of the fluid to be tested. Thus, if in a distilled malt liquor, the instrument sinks to 50°, it indicates that this contains 50 parts of alcohol and 50 parts of water.

Tralles's alcoholometer indicates the contents in the same manner by measure. Whisky of 30° T. contains, therefore, in 100 parts, 30 parts of alcohol and 70 parts of water by measure.

Beaume's areometer is the most in use. In order to weigh fluids that are heavier than water, such as malt beer, sirup, sugar solution, etc., 60°, measuring downward from 0, is usually taken as the point at which it stands in pure water.

In determining specific gravities, water is assumed as the unit, its weight being denoted by 1, or, for convenience of notation, by 1000. If the areometer indicates the specific gravity of a fluid to be more than 1000, it is by so much heavier than water; if less than 1000, it is by so much lighter. Thus, if a solution of sugar in water has a specific gravity of 1010, we understand that if a certain number of cubic inches of water weighs 1000 ounces, the same quantity, by measure, of the fluid weighs 1010 ounces: such a solution contains 1000 parts of water and 10 parts of sugar.

In comparing the degrees indicated by Beaume's areometer in fluids containing sugar with their specific weight, the following table will be found useful:

Degrees after Beaume.	Specific Gravity.	Degrees after Beaume.	Specific Gravity.	Degrees after Beaume.	Specific Gravity.	Degrees after Beaume.	Specific Gravity.	Degrees after Beaume.	Specific Gravity.
0	1000	11	1081	21	1167	31	1267	41	1386
1	1006	12	1090	22	1176	32	1278	42	1400
2	1013	13	1100	23	1186	33	1289	43	1413
3	1020	14	1106	24	1195	34	1301	44	1427
4	1028	15	1114	25	1205	35	1312	45	1441
5	1035	16	1125	26	1215	36	1324	46	1456
6	1042	17	1132	27	1225	37	1336	47	1470
7	1050	18	1140	28	1235	38	1349	48	1485
8	1058	19	1148	29	1246	39	1361	49	1500
9	1065	20	1157	30	1256	40	1374	50	1515
10	1073								

By the aid of this table it will be easy to calculate how much sugar is contained in any solution. For instance, if a solution shows 15° B. (=1114 specific gravity by the table), we have to ascertain how many cubic centimetres of sugar are contained in a given quantity, say 1000 centimetres. Now sugar has a specific gravity of 1600; that is, one cubic centimetre weighs 1600 grains, while one cubic centimetre of water weighs 1000 grains. We will indicate the unknown quantity, the amount of sugar, by x. Then,

$$x=\frac{(1114-1000)\times 1000}{1600-1000}=\frac{114{,}000}{600}=190.$$

That is, 190 cubic centimetres of sugar were contained in 1000 cubic centimetres of the fluid. Consequently, there were in the 1000 centimetres of fluid,

Sugar	190	cubic centimetres.	
Water	810	"	"
	1000	"	"

The above are the quantities by measure; by weight they are,

Water	810 cubic centimetres	=	810	grains.
Sugar (1114−810)=314	" "		314	"
			1114	"

For practical use, it is, however, more convenient to have the stem of the areometer graduated in such a manner as to indicate the quantity of a body dissolved in a certain quantity of the fluid.

The point to which the stem of the areometer sinks in pure water is marked 1000; that one to which it rises if, at a temperature of 14° R., 5 parts of sugar are dissolved in 1000 parts of water by weight, is marked 1005; the point to which it rises when 10 parts of sugar are dissolved in 1000 parts of water, by 1010, and so on. Each of these intervals may also be divided into five degrees. The areometer will then indicate, if standing in a fluid of 1020 containing sugar, that in 1000 parts of it 20 parts of sugar are dissolved.

The same mode of indication can be adapted to *measure* as well as to *weight.* Thus, the point where the stem stands, when one pound of sugar is dissolved in a certain quantity of water, may be marked by 1, that where it stands when two pounds are dissolved by 2, and so on. Most saccharometers and must-scales are made after this manner. Some, however, have a different principle. In these, the point where they sink in pure water is marked by 0, and small weights are then placed upon a little plate fixed to the upper end of the stem, in order to press this down to 0 into the fluid, in which it will not otherwise sink thus far. Now suppose we have to add to a certain must 50, to another one 70, to a third 90 of such small weights, in order to make the scale sink down to 0, the proportion of the specific gravity of these musts to that of pure water (the water being taken at 1000) will be, that of number 1, as 1050 to 1000; that of number 2, as 1070 to 1000; that of number 3, as 1090 to 1000. This is generally expressed thus: "The must number 2 is by 20 degrees better than number 1; the must number 3 is by 40 degrees better than number 1."

Of this construction are the Baumann-Kinzelbach *Wine-must Scales* and those of Hahn. The first may also be used to determine the specific gravity of fermented old wines by the degree marked by the number on the scale in the stem down to which the instrument sinks in the wine. This scale ranges from 0 to 10. For instance, if the instrument sink down to the number 6, the specific gravity of the wine will be 1000 less 6, or $\frac{994}{1000}$ of the weight of water; if it sinks to 9, the weight of the wine will be =1000 less 9, or $\frac{991}{1000}$ of the weight of the water. This latter wine is consequently better than the former, because the value of old wine is determined by the alcohol in it, and the less it weighs the better it is.

The must-scale used exclusively by the "Company for Improving the Grape Culture" in Saxony indicates by degrees, 1 to 80, how many half ounces of sugar are contained in one can, Dresden measure, of must (1 English gallon=4.85 cans). Of course, we can not assume that if a must-scale indicates that a must is =10 or 20 degrees heavier than water, the excess in weight is nothing but sugar. There may also be portions of salts, mucilage, acids, and so forth. Sugar, however, forming the main part of the must,

and large parts of acids and salts being indicated by the taste, and the mucilage weighing but little, the greater weight of the must may be taken as a sure sign of the greater quantity of sugar in it; consequently, of its greater value. To ascertain this correctly, the must has only to be still *sweet*, and not made cloudy by earthy, yeasty, and thready parts, as these may hinder the proper sinking of the instrument. The fluids we wish to weigh must also have an equal degree of temperature, as heat expands bodies; and a like quantity consequently weighs less if warmer than a colder one of the same contents.

Mr. Berg says of the must of Würtemberg grapes that such as weigh 1060 or less make a bad wine; that of 1065 an inferior, but drinkable; and heavier, up to 1080, a better and better quality.

If the specific gravity of the must amounts to 1060 or 1070, the sugar gets, at the first proper fermentation, so dissolved that the taste can hardly discern it. If the specific gravity rises to 1075, or still higher, the wine is only a little sweet; if it rises still more, to 1085 or 1090, a great quantity of sugar remains in an undissolved state after the first fermentation, which is not changed until later into alcohol by a continued still fermentation; the wine not only getting by it more durable, but also stronger, provided it is kept in good casks.

Besides the sugar, the other matters contained in the sweet must, such as vegetable acids, mucilage, tannic acid, etc., seem to add but little to its weight. As soon as the first turbulent fermentation is passed, the specific gravity of the must sinks to that of water, and grows lighter the more alcohol has been formed. The weight of such alcoholic wines is usually only by 0.010 or 0.012 larger than that of water mixed in the like proportion with alcohol.

The Wine-Scale serves also to prove old wines under certain precautions. Wines of equal color and the same vintage are usually the richer in alcohol the lighter they are. Neckar wines, for instance, of the vintage 1825, showed, after eight months,

Specific	gravity	993,	alcoholic	parts	11.2	per	cent.
"	"	994,	"	"	10.8	"	"
"	"	997,	"	"	7.0	"	"
"	"	999,	"	"	6.4	"	"

Old wines have in proportion frequently a larger specific gravity than newer ones, also dark colored ones more than light colored. The alcohol is closely united to the other parts of the wine, and, in order to obtain all of it out of a wine, usually more than two thirds of the must has to be distilled over again.

The Acid-Scale.

This is constructed similar to the vinegar-scale. A narrow tube, closed at its lower end, has near the bottom (which point is marked by 0) division lines marked 1, 2, 3, etc. It is filled with

wine, which is colored red by a tincture of litmus. A weak alkaline or nitrogenic solution is then added dropwise until the red color changes into blue, the sign that the acid has been neutralized. The more of this solution it takes, the more acid is contained in the wine. That which is specifically the heaviest, and therefore richest in sugar, has usually the least proportion of acids.

The Fermentation, or Carbonic Acid Scale.

This consists simply of a tube, the bore of which is marked off into cubic inches, in which the carbonic acid produced in fermentation is caught. The principle of its use is this: One grain of sugar, according to Döbreiner, produces $\frac{94}{100}$ cubic inch of carbonic acid. The quantity of the sugar, and consequently the quality of the must, can therefore be ascertained by the quantity of carbonic acid which it develops. For instance, if $\frac{1}{10}$ cubic inch of must gives $1\frac{1}{2}$ cubic inches of carbonic acid, $1\frac{57}{100}$ grain of sugar must consequently have been contained in it ($\frac{1.5}{0.94}=1\frac{57}{100}$).

One grain of sugar gives, farthermore, during the fermentation, $\frac{51}{100}$ grains of alcohol; or, when $\frac{94}{100}$ cubic inches of carbonic acid are formed, $\frac{51}{100}$ grains of alcohol are at the same time produced. If, therefore, $\frac{1}{10}$ cubic inch of must has by fermentation developed $4\frac{70}{100}$ cubic inches of carbonic acid, it contained 5 grains of sugar ($\frac{4.70}{0.95}=5$ grains), and has formed out of it $2\frac{55}{100}$ ($5\times 0.51=2.55$) grains of alcohol.

For this purpose serves a tube, divided into cubic inches, into which the developing carbonic acid is caught.

III.

MANUFACTURING GRAPE WINE.

General Observations.

So many different causes influence this that hardly two casks of the same sort of wine are exactly equal in all their points.

If the wines are filled in casks or bottles after the must has gone through the first fermentation, and before all the sugar has been dissolved by the after fermentation and the yeast secreted, they will continue to ferment more or less strongly, and to develop a great deal of carbonic acid, which may burst the casks if quite filled. The gas rises in a multitude of small bubbles, spouting up when the casks are opened, in case they withstand the pressure. Such wines are called *effervescent.* The kind most known of them is the Champagne.

If the fermentation is allowed to go to its full end, so that all

the sugar gets dissolved, the so-called "*dry*" or "*sour*" wines are obtained.

If, on the contrary, a large part of sugar is still contained in it, the wine is called "*sweet.*" These usually re-ferment.

Those *sweet* wines that are at the same time of a thick juice are called "*liqueur wines.*" Such are mostly produced in warm climates, as the must of the grapes grown there contains too much sugar and too little water and yeast, and, therefore, does not completely ferment. In an artificial way they are produced by allowing the grapes to dry on the bush or in the sun, or by adding lime to the must, or by boiling down a part of it. These latter are called "*boiled wines.*"

In colder climates the wine is sometimes made stronger by letting the watery parts freeze out, thereby giving them also a peculiarly agreeable taste. These are sold as "*frozen wines.*"

The peculiar agreeable flavor of wines is styled the *bouquet* ("*blume,*" in German). It is especially found in fine qualities.

The method of making wine differs in almost all countries, even in particular districts, though each of them adheres to its own as the best, or, in fact, the only good one. Some of the principal methods we shall describe hereafter.

The Time of Gathering the Grapes.

It ought to be a policy always to undertake this only when they have attained their highest state of maturity, as it is well known that they are the richer in sugar the riper they are, and produce the more alcohol the more sugar parts are contained in them. Even over-maturity, rottenness, and frost do not harm them, as they will also get sweeter by them; and the must made of such grapes will give a wine richer in alcohol and aroma. The rottenness, however, it may be premised, must not take place when the grapes are unripe, as this would destroy the little sweetness already contained by them.

It is not always possible to let the grapes get over-ripe—sometimes not even ripe—on account of the unfavorable state of the temperature and weather. In such cases, an increase of the sugar and an improvement of the must may be obtained by the following means:

1. The grapes, with their pedicles left on them, are spread upon mats, or flat vessels, and exposed for maturing to the influence of the sun, air, light, and dew. This is frequently done in Spain.
2. They are placed upon layers of straw, and allowed to ripen in warmed rooms. This method is used in Germany with the so-called "*straw wine.*"
3. They may be put uncrushed into vats, and left three or four days in them, for the same purpose.
4. They are, when gathered, exposed to a moderate cold, but immediately pressed when beginning to thaw.

5. Boiling them by steam.

The maturity of the grapes is indicated by the berries attaining their perfect color and clearness, and beginning to get wrinkled; by their skin getting thin, the stones loosening easily, and becoming darker in color; by the pedicles darkening, wrinkling, and letting the grapes droop.

The gathering of the grapes can be done at all hours of the day, and in all kinds of weather. If done on rainy days, more, but weaker wine, and less well colored, will be produced. If the production of the best wine be an object, the grapes must not be gathered until the dew has dried off. If the grapes are very sweet, however, this makes no difference; likewise if effervescent wines are the object.

The most profitable way is to have wooden tubs that will not let the juice escape, and to be careful to cut the grapes off with a pair of scissors, so that no berries get wasted.

If the quality of the wine be no especial consideration, all the grapes, no matter whether ripe or not, are crushed together. It is different, however, if a good wine is wanted. In this case they must be picked out, and the more carefully the better the wine is required to be.

As the stalks give the wine an unpleasant harsh taste, it is well to separate them from the berries before the pressing. Only in such cases it is desirable to leave them if the grapes have too little acid and sour parts, but many mucilaginous ones. If the wines are destined for the fabrication of cognac, nothing is taken off, as all the parts make alcohol, and the acid matter does no harm to it, remaining in the still.

There are different modes of picking off the grapes:

1. By the hand only.

2. By a wicker frame, with small holes through which the picked-off berries fall into the tub.

3. By the fork, which is of wood, 17 to 24 inches long and three fourths of an inch thick, parting in the middle into three branches. This instrument is moved about in the tub filled with grapes, holding it with one hand by the handle, with the other by one of the three prongs. The stalks are thereby separated from the berries and taken out.

Crushing and Pressing the Grapes.

The first is usually done in the vineyard, in a tub placed in a slanting position, by "*treading*" them with the feet, or by crushing with a wooden pestle. In the first case, wooden shoes, well cleaned, are put on.

If the juice is to be directly separated from the stones and skins, the tub must have holes in the bottom to let it flow out, leaving those inside. In the Rhine district the treading method has been generally adopted, because the *aroma*, being mostly held

by the skins, is better developed in this manner, and wines so produced have a much stronger bouquet than if made by any other method.

The tubs have a lid which covers the vat underneath, in order to shut the air out from it. This lid or board has a large round hole, surrounded by a wooden hoop one inch high, within which the upper tub is put so as to be immovable. It has likewise a small flap, through which one sees if the tub is filled, and also may push the husks back that rise in the middle.

If the must, however, is to ferment with the skins and pedicles, the whole mass is left together, and is pressed off from the husks when the fermentation has more or less advanced.

In the *press-house* the mass is either pressed at once, or allowed to ferment with the skins and stalks, or with the first only. In the latter case, the wine gains in color, taste, flavor, and spirit, as the husks always contain sweet and spicy parts that get freed by the fermentation. It gets also sooner drinkable, as the acid and tannic parts of the berries effect a quicker secretion of the yeast. But it is also sourer and more acid; therefore it is frequently preferred to leave the skins and stalks aside.

This is done by the *pressing process*, to which the whole mass is subjected in a fresh-crushed state, or in that of a more or less advanced fermentation. The juice first coming out here is that of the most ripe grapes; consequently it is the sweetest, and gives the best wine. After this it contains more and more acid and sour parts, and makes only inferior wines. From this the names of "wine of the first, second, third press" are given, as also *prime*, *press*, and *husk wine*. If the grapes have but little water, warm or cold water is poured on the pressed-out husks, which are then pressed again.

The husks on the sides of the tub are not exposed to an equal pressure with those in the middle. They are consequently cut off and pushed toward the centre after each pressing. In Würtemberg the common broad-axe of the carpenters is used for this purpose. In other districts they have particular implements for the same object.

Only the must of grapes gathered and pressed at the same time must be put into one vat, as otherwise the fermentation would be unequal and the wine less good.

Fermentation.

The must is now left to ferment: in northern climates usually in cellars; in southern, under sheds. If it is in large tubs or vats, its own heat is generally sufficient to get it into proper fermentation even at a low temperature; but if this should not be the case, artificial warmth must be applied. The cellar, in that case, if covering with warm blankets will not answer, is warmed by a coal fire, or some of the must itself is warmed and pour-

ed into the vats through a long funnel, that it may get to the bottom.

The fermentation may take place in *covered*, in *partially covered*, or in open tubs or vats.

The must may furthermore be allowed to ferment *above* or *below;* that is, the vats may be so constructed that the must ejects *above* all the slimy, thready, and yeast parts which are driven upward. This may easily be caused by keeping the tubs all the time so well filled that the crust is ejected over the border; or these parts may remain in the fluid and settle on the bottom toward the end of the fermentation, in which case it takes place below. The wines made by the first manner are usually sooner drinkable, but also of less body.

When the fermentation subsides the bungs must not be closed at once, but only lightly covered, as carbonic acid still develops itself, and, when the temperature changes, the fermentation frequently commences again.

A disadvantage of the fermentation in open vats is that the surface of the must comes too much into contact with the air, gets cold by this, sour, and gives the wine a disagreeable taste. In order to prevent this, it would be wiser to close the vat entirely, and let the air escape by a crooked pipe whose mouth lies under water. By this construction the outer air is perfectly shut out from the must, and all fermentation of acetic acid is prevented. A part of the carbonic acid and the alcohol evaporating with it is likewise retained by the water.

The advantages of this method are farther:

1. That the fermentation takes place more quietly, consequently with less inner heat, though slower.

2. The result will be not only more wine, but also one richer in spirit.

3. The red wine especially gets a finer color, as the air does not extract the coloring matter.

4. The wine is less exposed to danger of changing suddenly and getting sour.

5. A fluid is got in the receiving water containing carbonic acid and alcohol, which may be profitably used for making vinegar or alcohol by distillation. It has also been used for bathing and drinking purposes.

Filling in the Must.

The time of the fermentation depends greatly on the temperature, the nature of the must, and the quality of wine that may be wanted. In warmer climates it is frequently done in twelve hours; in others it takes from four to fifteen days, and even four weeks. Wines of but little sugar must be filled into casks before the visible fermentation ceases, as they are much exposed to sudden changes. Wines that came out of a slow fermentation are

always more durable than those of a quick one. In such too much alcohol escapes. It may, however, be retarded by decreasing the warmth, or by burning sulphur in the vats.

The greatest possible cleanliness is absolutely necessary during the process. The edges of the bungs have to be frequently cleaned; and care must be taken that no parts changed by the air reenter the wine.

When filling it into the casks all the husks must be left out, as these are pressed over again, either to give an inferior quality of wine or to make vinegar. The casks are filled up to the bung; but if the wine be subject to a strong after fermentation, only up to within several inches below the bung-hole. The bung-hole must only be lightly covered by a leaf or a stone. Every second day the cask must be filled up again.

The finishing of the first after fermentation may be known when no more air-bubbles arise, and the stone on the bung-hole does not become moist any more. When this is the case, the hole must be closed tighter. The filling up must, however, be continued every eight days at first; later, every fourteen days; and still later, every four weeks.

As the young wines, especially if they contain many slimy parts, deposit a great deal of yeast, they must be *drawn off* from this from time to time. The rules about this are, however, different in all the grape countries.

The Making of Sweet Wine.

Wine is called sweet in which only a part of the sugar parts are decomposed, and, consequently, the fermentation is not entirely finished. This might be attained by filling the young wine into closed casks before it has fermented out, and checking this latter process by an addition of salt, mustard, etc. The wine would then, however, not get clear, but would easily relapse into fermentation. It is, therefore, better to take must containing much sugar and but few yeast parts. As this will not be sufficient to decompose all the sugar, a part of it will remain undissolved in the wine. The grapes of warm countries generally have these conditions by nature, and consequently produce sweet wines.

They are still made richer in sugar by boiling down a part of the must and adding this to the rest; or the yeast parts are reduced by boiling and scumming the must, or adding gypsum that decomposes the cream of tartar. An addition of sugar would likewise tend to the first end, and a filtering through charcoal to the second.

In Portugal they add spirit (that makes a part of the yeast incapable of fermentation) to produce the celebrated Angelica or Geropica wine. Sweet wines need, for the most part, an artificial clearing.

In Alsatia they select the best and ripest grapes; leave them as

long as possible on the bushes until the stalks become dry. They gather them on a warm, clear day, and lay them on straw (therefore the wine is called *straw wine*); or hang them up on rafters or poles provided for the purpose, taking care, however, that the stalks where they are cut look downward, in order to give the berries more room to stand off from one another, since if they were close pressed they would be apt to rot. The room in which the drying is done must be airy, not too warm, and closed against strong cold. For the first days the windows are left open; afterward opened at least once in every few days. The more the grapes dry, the more delicate against cold they get. In this room they leave them until March or April, frequently picking out the rotten berries. Then they take them down, and pick the berries off singly, and crush and press them. The juice is then at once put into a tub, not quite filling it. The fermentation proceeds very slowly, frequently lasting five to six weeks. If the temperature be somewhat cold, it is advisable to place the tub in a room of about 12° to 14° R. After the fermentation is over, the tub is filled up by a quantity left for the purpose. This wine remains very sweet indeed for a long time, and grows finer by age, choicer, and more delicious. Its cloudiness always clears off again by its own action. It will never turn sour as long as it may be kept.

The husks of these grapes serve very well to improve ordinary wines if thrown into the casks of the latter, stirred up from time to time, left in them a few days, and then the wine is drawn off and mixed with other. A new fermentation commonly sets in, producing a highly improved wine.

Making Frozen Wine.

The wine freed of part of its water by the process of freezing not only gains by it in strength, but gets, also, the appearance of an old wine and a peculiarly agreeable taste. For these reasons, it has been for a long time a custom in Franconia, on the Rhine, and in Moldavia, to improve young wines in this manner:

The wine is put into small barrels, not quite full, or into tubs, and exposed to the winter cold. The ice-crust formed is in the beginning broken until sufficient water is frozen out, and the remaining wine filled into a freshly-sulphurized cask. If the crust gets into compact masses, these must be broken up by a red-hot iron. After the dropping off, the ice contains nothing but some cream of tartar and impure matters. This procedure is, however, not recommendable with red wines, neither for effervescent ones.

Making Young Wines appear "Old."

1. Take a new cask with stout hoops, wash it well out with yeast liquor, and fill it three fourths with must. This will soon get into fermentation, and must, after this is past, be drawn off

into an old wine-cask, and may be repeated over again until spring comes.

2. Mix a little lime-water with it. This will make it mild.

3. Let it freeze.

4. Throw red-hot flint-stones into it, one after another, and draw the wine off in about six weeks. The slimy matters will settle on those stones.

5. Put some oak wood into the cask. This will give the wine color, and removes slime. It is, however, not very recommendable.

6. Take it, in good casks, to a warm place—for instance, to a warmed room. A few weeks will suffice.

7. Put it into a cask in which old wine had been contained.

8. Mix it with a little wine-ether.

IV.

CLASSIFICATION OF THE WINES.

JULLIEN puts them into *five classes.* The first comprises the fine wines, of the prime superior quality, only produced in small quantities. The second, the fine wines of a really good quality, made in a larger quantity, and generally confounded with the former. The third, the fine and middle-fine ones. The fourth, the ordinary ones, commonly called of first quality. The fifth, those of the second and third quality, and the most inferior ones.

According to this system, he classified the most superior wines as follows:

I. RED WINES.

First Class.

Of Burgundy.—Romanee-Conti, Chambertin, Richeburg, Vougeot, La Tashe, St. Georges, Corton.

Of Bordeaux.—Lafitte, Latour, Chateaux-Margeaux, Haut-Brion.

Hermitage: First quality, Of the Vendée.

Second Class.

Of Champagne.—Verzy, Verzenay, Mailly, St. Basle, Bouzy, St. Thierry.

Of Burgundy.—Bosne, Nuits, Chambolle, Volnay, Pomard, Savigny, Beaune, Marey, Meursault, Olivates, Pitry, Perriere, Chainette, Migrenne, Auxerre.

Hermitage: Second quality, the Cote-Rotie of Lyons.

Of Bordeaux.—Rozan, Gorse, Leoville, Larose.

Coteaux-Brulé of Avignon, Turancon and Gan of Bearn.

Of Rousillon.—The Vagnals, Casperon, Collioure, Terrats.

Third Class.

Of Champagne.—Hautville, Marcuil, Disy, Pierry, Epernay, Taisy, Ludes, Chigny.

Of Bordeaux.—The Pauillac, Margaux, Pessac, St. Julien.

Of Burgundy.—The Gevrey, Chassagne, Aloso, Llagny.

Of Languedoc.—The Chuzelan, Tavel, St. Geniez, Lirac, Ledenoa, Cornac, Cante-Perdrix.

Fourth and Fifth Class.

All others, too numerous to be mentioned.

II. White Wines.

First Class.

Of Champagne.—Sillery, Ay, Mareuil, Hautviller, Pierry, Dissy, Clozet.

Of Burgundy.—Montrachet.

Of Bordeaux.—The dry wine of St. Bris, Carbonnieux, Pontac, Sauternes, Barsac, Beaumes, and the Preignac.

The Hermitage, and the Chateau-Grillet.

Second Class.

Of Champagne.—Cramet, Avise, Ogne, Le Menil.

Of Alsatia.—Gebweiler, Turkheimer, Rîqueville, Thanner, Pfaffenheimer, Rufacher, Kaisersberger, Molsheimer.

Of Burgundy.—Perriere, Combotte, Charmes.

Of Franche-Comté.—Chateau-Chalons, Arbois, and Pupillin.

The Condrieux, Department du Rhone; Langon, of Bordeaux; Montbasillace, St. Nessons, and Sancé, of Périgord; St. Peray and St. Jean, of Languedoc.

Third Class.

Some sorts of Burgundy and of Bordeaux.

III. Liqueur Wines.

First Class.

Tokay, from Hungary; Lacrimæ Christi, from Napolis; Muscat, from Syracuse; Commandery Wine, from Cyprus; Constantia, from the Cape of Good Hope; Rivesalter, from Roussillon; and several straw wines from Alsatia, and that of the Hermitage.

Second Class.

Frontignac, Lunel, and other Muscat wine, from Languedoc: Grenache, from Rousillon; and the Maccabee, from the Pyrenees: the better sort of Alicante and Malaga; Grenache, from Aragon: those of Setuval, Carcavellos, and Bucellas, in Portugal; the sweet

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wines from Vesuvius, from Syracuse, the Lipari Islands, Albano, Monte Fiascone, etc., etc.; the Chiras, from Persia; Muscat and Rota, from the Cape of Good Hope; Madeiras and Teneriffes.

Third Class.

Several white Alicante wines; several from Upper Italy; the straw wine of Würzburg, and the Calmuth wine of Aschaffenburg; the wine of Chiavenna; the Karlowitzer; the second quality of the Muscat of Languedoc; the Picardan.

IV. Dry Wines.

First Class.

Johannisberger, Rüdesheimer, Deidesheimer, Badenweiler.

Second Class.

The first qualities of the Rhine wines, principally Hochheimer, Laubenheimer, Nierensteiner, Brauneberger; the Ruster, Menescher, the Karlowitzer; the dry Xeres, Paraxeta, Olivenza; Port wine.

Third Class.

The wines from the Upper Rhine; the better sorts of Franconia wines; some from Bohemia and Würtemberg.

V.

OF DRAWING OFF THE WINE.

The purpose of this is to separate the wine from its yeasty parts. It must, consequently, be principally done at times when influences of the weather dispose it to ferment again. The seasons are when the grape-bush shoots anew in the spring; when it blooms in the months of May and June; in August, and when the grapes mature in September; and in the beginning of winter, when rainy weather lasts for several days. It ought to be a rule to draw off before such influences set in. Against those of very stormy weather the wine may be partially protected by closing the doors and windows of the cellar in which it is kept. If fermentation, however, takes place, it is better to loosen the bungs to give the air free egress, and let it go on, or to check it by sulphurization.

Rhine and other sour wines are generally drawn off three times during six years, at the above-mentioned times; then they are left undisturbed for three years, being only looked after from time to time, and the bung-cloth changed.

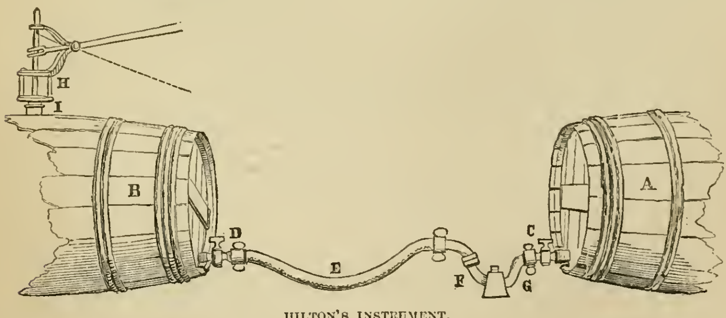
Frequent connection with the air often injures the wine, as a

great quantity of spirit evaporates each time, and it thereby gets weaker, especially if done on warm days. To prevent this as much as possible, the opening ought always to be done on cool days, when the north wind blows, never during a south wind. To prevent the combination with the outer air, various methods are recommended, some of which we will here describe.

The drawing off is usually performed as follows: A hole is bored into the cask at a certain height from the bottom, where it is supposed that the wine may no longer be clear; through this hole the wine runs out by means of a tube or pipe. In order to let the air enter the cask, the bung is opened, or a small hole bored through one of the staves. When the clear wine is all out, the cask is lifted up until the thick or muddy portion runs out. This is then filled into another cask.

A better method is that with a leather pipe, four to six feet long, one end of which holds a tube. This is placed tightly into the bung-hole of the cask to be filled, the other end being attached to the faucet of the cask to be emptied, which must stand higher. The wine runs through this pipe to the other cask until it is half filled. Now the attendant must blow into the upper cask through a bellows having a leather cap over its mouth to prevent the air from re-entering it, and drive the remaining wine out of it through the pipe.

The mode of drawing the wine off by means of a siphon has the advantage that the connection with the outer air may be almost wholly avoided. The siphon is filled with wine, and the short arm is placed in the cask to be emptied, the long one into that to be filled. The contents of the first barrel then pass into the second. The use of the pump for drawing off wine is mostly confined to Champagnes.



HILTON'S INSTRUMENT.

Preferable to this is, however, the method of drawing off by a "Hilton's Instrument," which offers the advantage of its being quickly done, without allowing the wine to communicate with the air. A shows a cask filled with wine. B is a cask into which this wine is to be transferred. C and D are faucets screwed into

the casks about one and three quarter inches from the bottom. F is a crooked piece of pipe preventing the air from passing over with the last of the wine. At G two glasses are placed, allowing the condition of the wine to be ascertained. H is a sucking-pump with a conical screw, which is screwed into the bung-hole of cask B. After opening the faucets C and D, screwing in the pump and starting it, a partial vacuum is formed in the cask, and the pressure of the atmosphere drives the wine immediately over out of A into B. As soon as it has sunk to near the bottom, the faucet D is closed, and the cask A carefully lifted. The wine is thus drawn off without muddying it by the yeast. Below, the pump has a hole (at I) through which the air escapes, which is closed when this is done.

Filling the Wine into Bottles.

This is usually done by means of a faucet, from which it runs into the bottles through a funnel. It comes, however, less in contact with the air if let off by a siphon, but mixes itself with the yeasty parts stirred up in the cask. An improvement in the construction of the former instrument preventing the first cause of complaint, seems to make the simple old fashion more preferable.

As a rule, wines must not be bottled until their fermentation is completely over, otherwise many bottles would likely burst.

White wines may be bottled without danger after a year or eighteen months; so, too, liqueur wines or light red wines. Others of a heavier body (as, for instance, the Chambertin, the Corton) must not be bottled before three or five years. Bordeaux and Rhine wines are best left eight to ten years in the casks.

The bottling should be done in cool weather. In the district of Champagne, in France, the time of the full moon in the month of March is preferred for *effervescent wines;* for others, the waning of the moon.

The bottles must only be filled to within two inches of the mouth, so that, after corking them, a small vacuum remains between the cork and wine. This is done to prevent bursting.

VI.

TREATMENT OF BOTTLED WINES.

A CHIEF condition for the preservation of such is to keep the bottles always in a level position, so that the cork is covered by the wine. If not, mould will soon cover and make it sour.

In the course of time, however, they secrete a sediment, of which they must be freed before they can be used or sent off. If it be clean and sand-like, it is only cream of tartar, and may re-

main. The filling from one bottle into another is simply done by leaving the sediment back.

Filling up and Wasting of Wines.

Even in the best-made casks an evaporation of the spirit and watery parts of the wine takes place, escaping through the seams, forming, consequently, by the diminution of it, a vacuum above it. This is called "the wasting" of the wine. No remedies against it have proved effective; the only thing to be done is the timely filling up of the casks, for the air, coming into contact with the wine, would otherwise spoil it. A younger wine, though similar in quality or taste, is generally taken for this purpose. Before it is done, the air must be blown out of the cork by a pair of bellows, or the empty space be sulphurized. If wine has been freshly drawn off, it must be filled up within the first twenty-four hours, especially if the casks are new, for these draw a great deal of fluids in; again in about eight or fourteen days; later, in three or four weeks, and so on.

In case the wine should be mouldy, it must be filled up by means of a pipe laid under its surface, so as not to drive the mould under it. When the cask is full, this must be taken off with a spoon. If the mould should be mixed already with the wine, this must be drawn off through a faucet whose mouth is covered by a piece of gauze.

In case there should not wine enough be left to fill a cask sufficiently up, the empty space in it must at least be sulphurized every four to five days, and fresh air blown into it. The bung-cloths must at every filling up be well washed or renewed, as they easily tend to make it sour.

Of late it has been recommended to put glass bells upon the bung, thereby greatly facilitating the filling-up process. These are fixed by cork stoppers, by boring a conical hole, of the thickness of the lower part of the tube of the glass bell, through a piece of cork. The tighter this is let into the bung-hole, the more secure will be the result. It will be well, however, before letting it in, to dip the cork into hot water for several minutes. After all this is done, the glass bell is turned into the hole of the stopper to about two thirds of the tube, so that it is felt sticking tightly. It is then filled with the same kind of wine as that in the cork, and the upper mouth of it closed by an ordinary stopper. A few days after it is filled up again, until the wine has settled, and it will then be seen that it remains in the bell. The farther filling up may be repeated every two or three weeks. These bells must be from three to six or eight inches wide, and the six to ten-inch long tubes have an upper mouth one and a half inches wide.

The advantages presented by this method are: 1. That no mould can be formed; 2. It results in much less sediment or yeast; 3. The wines, if once clear, need less drawing off.

VII.

CLARIFYING WINES.

In most wines clarification results from their own action, as the yeast parts settle down as soon as the fermentation is over. Especially is this the case with dry wines, *i. e.*, such as have perfectly fermented out, and these need no artificial help.

It is, however, different with sweet and oily wines, in which the still undissolved sugar contains a great deal of yeast in an undecomposed state; and the slimy and extractive parts do not easily settle. With these it is necessary to add a slimy body, that mixes itself with them, then coagulates, and in this state absorbs all those parts.

Such substances are *animal jelly* and albumen (*white of an egg*). They are both dissolved in water, and stirred into the wine. The gelatinous matter coagulates, in conjunction with the tannic acid, into an insoluble substance. Consequently, it can only be used for clarifying such wines as contain tannic acid; or, if not, they must be made to contain it by a decoction of oak shavings or catechu poured into it, or by putting the shavings themselves into the cask. The white of an egg also forms a similar insoluble connection with the tannic acid, but coagulates by heat or strong spirit, and satiates a small portion of the vinous acids. It may, therefore, be used for wines that have no such tannic acids, if they are only strong in spirit. The wines that are to be clarified are usually not sulphurized.

The most convenient time for the operation are cool, pleasant days. Old wines are closed up after being mixed with the substance; young ones, generating much carbonic acid, are left with a small opening during the first day to allow this to escape.

The white of the egg is best stirred up with water before adding it to the wine. Three eggs will generally suffice for about 160 bottles of red wine. If not, it will be better to repeat the experiment than to take at once a greater number. In young wines a little salt may be safely added.

The clearing by isinglass is done by beating this material first with a hammer, then tearing it into small pieces and putting them into a vessel containing wine. This is poured off in about eight hours, and new ones added. After twenty-four hours a jelly will be formed, to which hot water must be added; then the mass is kneaded with the hands to accelerate the dissolution, strained, and beaten, with the addition of a little more wine, for about a quarter of an hour. In this condition it is mixed with the wine in the cask. One litre of isinglass will suffice for about 240 or 260 bottles of white wine. In Germany one half to two ounces of it are taken, according to circumstances, to one fuder; in France,

half an ounce to 80 or 100 bottles of wine. Two or three weeks after the clarifying with isinglass the wine may be drawn off. It is mainly used for Muscadine, Lunel, Frontignac, Malaga, and all the various "liqueur wines."

Clarifying with bone jelly is performed in a similar manner. The substance is previously soaked in water for a few hours and beaten. It is preferable to the former, as, once settled down, it does not easily rise again to mix with the liquid, being heavier than other kinds of glue. Five grammes of it will do the same work as the white of four eggs. Especially for red wines it is recommendable. One pound of bone jelly is sufficient for 25 hogsheads of it; in liqueur wines one pound is taken for 15 hogsheads.

If clearing with milk is tried, this must be boiled, and skimmed off to remove all the fat parts, and one maas of it mixed with 150 bottles of wine.

Sheep's blood may also be used by taking half a maas of it (when fresh) to 150 bottles. In France it is sold for this purpose in a dried and powdered state.

In clarifying with resin, this substance must be finely powdered, and thrown over the whole surface of the wine after taking a few bottles of it out of the cask by a siphon. This must be filled in again in a fortnight. The resin is dissolved gradually, and sinks to the bottom, clearing the wine, which must be drawn off afterward. One ounce of resin is sufficient for 400 bottles.

"Dyer's Clarifying Powder," patented in England in 1835, is composed of dried blood, dried white of eggs, dried bones of young animals. When used the powder is stirred with water, left standing for eight hours, and then mixed with the wine. Mr. Dyer dries the blood and white of eggs in the air.

With blotting-paper: This is put into the wine rolled up in such a manner that, gradually unrolling, it expands itself, and, settling down, carries all the muddy parts with it to the bottom. This method is, however, not very effective.

By red-hot stones: Gradually introducing them through the bung-hole, and leaving them for about six weeks in the cask. For young yeasty wines this mode is of advantage, as it makes them milder, richer in spirit, and of improved taste and color. After the wine is drawn off the stones will be found covered by a thick slime.

Clarifying with coal is done by using half a pound or a pound of powdered charcoal to one eimer of wine, and leaving both for eight days in connection.

VIII.

GIVING COLOR TO WINES.

This is principally done with *red* wines. In Bordeaux the whortleberry (*Vaccinium myrtillus*) is mainly used. By boiling them a decoction is made, and a little cream of tartar added to this, then strained, and, with some alcohol, filled up in bottles for use.

The following substances are also used to give color to wines: the berries of the elder-bush; Brazil-wood; red beets; the flower-leaves of the mallow (*Althæa rosea*); the berries of the scarlet-berry (*Phytolacca decandra*); black cherries; the yeast of red wines; and very highly-colored red wines.

Weak wines are usually not well colored, because the coloring matter is mainly dissolved in the alcohol. In this case they must be mixed with spirit, 8 to 15 maas to the cask.

White wines receive an artificial yellow color by a solution of burnt sugar. Take 1 lb. of powdered white sugar, add a ¼ lb. of water, and stir it over a fire until it gets a dark brown color.

If red wines have a brown color, this is caused by the presence of too much lime or alkali. An addition of any kind of acid will remedy it.

White wines frequently get by age an unpleasant brownish color. Sulphurizing them, an addition of powdered charcoal *or of chalk*, will help here (one ounce to the eimer).

IX.

MIXING AND JUDGING OF WINES.

Mixing frequently proves of great advantage, as the prominent qualities of the one will effectually cover the lacks of the other. All, however, depends on the wines themselves, and no certain rules can be given. In France, those of the south, rich in sugar and alcohol, are mostly used to improve those of the north, or of inferior vintages. But even in the south they mix their wines with alcohol, to make them stronger and give them a clearer color.

Wines that are too thick or slimy must be mixed with light red or white ones. As the bouquet usually disappears by this proceeding, wines that are rich in it ought not to be mixed at all.

A really good wine must have the following qualities:

Its *color* must be bright and transparent, no matter of what shade it be. Young wines have it generally very light; the more

of age they become, the more this changes into dark. The darker, the more oily and earthy parts they contain.

The *flavor* must be agreeable and strengthening, the more so the finer the wine.

The *taste* must be a little sourish-sweet, and touch the tongue without acidity, much less contract it.

The impression upon the tongue should last for some time, and be without any earthy or other by-taste.

The *strength* and *fire* characterize it mainly, insomuch that, even if intoxicating, it does not effect or leave a heavy drowsiness, heat, headache, and thirst.

It must, farthermore, be *volatile* and *penetrating*, quickly open its own way, and disappear again. When poured into a glass a whizzing noise must be heard, and the wine must leap up in a multitude of small pearls.

It must have gone through a *perfect fermentation.*

In trying different qualities of wines, it is always well to take the sample (if it be from a cask) from the middle of it, and the examining person must take care not to eat, shortly previous to or during the occupation, any spiced or salted things, such as cheese, sausages, and so forth; nor sweet ones, as honey, coffee, etc.

X.

THE PRINCIPAL DISEASES OF WINES.

Sudden Changes.

THE cause of sudden changes in wines may be, 1. *Too large a quantity of yeast matter*, especially in sour wines not rich in sugar, where they continually try to change, first, the sugar into spirit, and this, then, into vinegar. 2. *A renewal of the slow fermentation.* If this sets in and is neglected, it may become very detrimental to the wine. This ought, therefore, to be several times drawn off from the yeast sediment in the cask. 3. *A change of temperature.* The wine drops, at a temperature of 4 to 8 degrees above 0, many firm parts from the decomposition, and its inner fermentation stops almost entirely. But at a contrary temperature of 14 or 15 degrees above 0, many of these get dissolved, and impart to the wine an unpleasant taste and more acids. 4. *Motion of the wine in the casks.* By this, the sediment and yeast matter get again mixed up with it, and the warmer the temperature, the more detrimental it becomes. A thunder-storm may also affect the wine on account of the influence of the electricity. 5. *Connection with the air, and an empty space in the casks.* These ought consequently to be avoided as much as possible.

The most efficient remedy against all these causes is to give

the wine always something whereby it may form alcohol: a sweet substance, for instance, such as boiled grape-juice, grape-sugar, or honey. Besides this, a good bed, quiet, and as little access of air as possible.

Of *sweet mixtures* used for this purpose, and also to give inferior wines a better taste and more body, we mention the following:

1. Prime Spanish raisins, without stalks and stones, are boiled with water; the decoction is strained, and mixed with alcohol (one maas to one pound of raisins). In the fall, this is mixed with four or five times its quantity of good must; let them ferment together, draw it off from the yeast, and preserve it in bottles. One maas of this strong juice is sufficient to improve one eimer of young red wine. But if this be sour, it must be made right again previously by an application of powdered chalk or coal. 2. Good must, mixed with the tenth part of its own weight of crushed sugar and the eighth part of its quantity of pure alcohol. 3. Selected grapes are allowed to get to perfect maturity in the sun, or in a heated room, and to dry. Their juice is then pressed out and boiled a little, or mixed with sugar and cream of tartar if too watery. In this manner it serves very well to improve weak wines. 4. One part of honey and two parts of old French wine are warmed over a small fire, and skimmed. Four maas are sufficient for one hogshead. 5. Shoots of the grape-vine are boiled in wine. This is good for such wines as have but little taste and color. 6. One ounce of cream of tartar boiled with six maas of water until it is dissolved; then one pound of barley to be added, and boiled till it bursts; then four pounds of honey added, stirred, and so much water put to it that the quantity amounts to six maas, and the whole used for a cask of wine of fifty cans. 7. In France, often nothing but "*grape-sugar*" is used, especially for wines destined for sale in the northern countries.

Souring.

This takes place if a part of its spirit changes into vinegar. In order to do this, it needs a stuff inducing a sour fermentation, and free access of the air. Water favors it, and alcohol mixed with a great quantity of water is, by the mere combination with the air, transformed into vinegar. The mould is a forerunner of it.

If the wine, therefore, has but few watery parts and fermentation matters, and is kept shut out from the air, there is but little danger of its turning sour. Likewise if it still contains many undissolved sweet parts. Reduction of the water, removing the yeasty matters, and preventing the air from coming into contact with it, are consequently the most available remedies. Souring takes place most readily with wine kept in badly-constructed cellars, or at the times of great changes of the atmosphere, and violent electric shocks.

For the purpose of reducing the quantity of water, an addition

of strong wine, of sugar, alcohol, or gypsum, is available. To prevent the detrimental influences of the air, the casks must be not only filled full, but also kept so, and closed well. Sulphurizing the wine serves also, and the fermenting of the must already in closed tubs. To reduce the bad influences of the yeast parts, all movements or shaking of the casks must be carefully avoided, as well as the changes of temperature.

If the wine should be just beginning to get sour, it will be sufficient to draw it off into another sulphurized cask, and to clear it with the white of an egg. If it be already more advanced, finely-powdered charcoal must be mixed with the wine (4 ounces to 1 eimer), and then drawn off, after a while, and clarified. The same effect is produced by roasted nuts (4 to 25 bottles).

If it is very far advanced, nothing is left but to satiate the wine with potassa ($\frac{1}{4}$ to $\frac{1}{2}$ oz. to 1 eimer) or with powdered chalk (2 oz). It must then, however, be used soon.

Rhine wines that get sour are usually cleared by a mixture of 10 lbs. of honey and 8 quarts of skimmed milk. Strong red wines are mixed with sugar or boiled grape-juice.

A preventive against mould are long bungs that enter deeply into the wine.

Becoming Glutinous.

This is a disease to which weak wines are especially subject, which have fermented but little, and consequently contain many slimy parts, or those in which the yeast has not been properly separated. Frequently it also happens to wines whose grapes were grown on a highly-manured soil. The remedies are such as will promote fermentation and strengthen the wine:

1. It must be drawn off in time into another cask in which new wine has been, and some alcohol or good new wine added.—2. Red-hot flint-stones may be thrown into the cask, and the wine be drawn off after four to six weeks.—3. Take 12 to 14 ounces of cream of tartar and the like quantity of brown sugar; dissolve these in four maas of wine; put this mixture, when hot, into the wine; close the bung of the cask, shake it for five or six minutes, tighten the bung, shake the cask for one or two days more; and after four or five days (when it has got clear), draw the wine off into another cask.—4. If the evil be not considerable, it may be sufficient to expose the bottles or casks to the free air; or, 5. To shake the bottles, and then open them to let the air escape, or to shake the casks.—6. If it happens to be at the time of the vintage, the wine may be allowed to ferment over again, with the same proportion of must.—7. *Red wines* are perfectly restored by a mixture with tartaric acid, about one oz. to the hectolitre.

By the addition of salt ($\frac{1}{2}$ lb. to 1 eimer) to the must toward the end of its fermentation, we may prevent the formation of glutinous matters. Sulphuric acid tends to the same purpose.

Woody, Mouldy, and Bitter Taste.

If the taste should not prevail to a great extent, it will be found satisfactory to draw the wine off into a new cask, and to sulphurize it well, or to suspend medlar-fruits by a thread in the cask. Fine wines, however, are better clarified by the white of an egg, and then drawn off after a month. In case the taste be very noticeable, freshly-burned charcoal, well washed, is best stirred into the wine, which should be afterward drawn off. In white wines, a mixture with lime-water destroys also the bitter and woody taste.

This taste may likewise be disguised by suspending such materials as powdered peach-stones, bitter almonds, wild sage, elder-flowers, sassafras, raspberry-sirup, cinnamon, tied up in a bag in the cask.

Wines of an acid taste are mixed with a good old one, or with wine-yeast or pure brandy, and afterward cleared. Powdered charcoal may also serve. The casks themselves may be purified of their sour taste by being washed well out with lime-water or the ley of ashes. Against the woody taste Mr. Lajuinais recommends to scrape off the inner sides of the casks and put oil of olives on them.

Cloudiness and Muddiness.

Wine is not clear as long as the yeast matter has not yet settled down, and it gets cloudy when these mix with it again. In sweet wines that have not fully fermented they remain very long, and must be removed in an artificial way.

This is done by *clarifying.* In a very simple way this may be achieved by putting boiled beech-wood shavings into a cask, drawing the wine into this, and off again after a little while, with the addition of a little salt, which induces the separation of the yeast matter. Some time after, the wine must be drawn off again into a new cask and sulphurized.

In case, however, wines remain cloudy that should have perfected their fermentation, this is a sign that they have not done so. Sugar may then be added, and means be employed which favor the fermentation; for instance, warmth: a mixture of warm must, an addition of red-hot stones, shaking the casks, or stirring up the yeast, and an addition of chalk or lime if too much acid should be contained.

If wines kept in a badly-constructed cellar get troubled by frequent shakings of the casks and influences of the air, they must be repeatedly drawn off from the yeast, cleared, and sulphurized.

Red wines are generally cleared, when getting cloudy, by a mixture of rain-water, a handful of salt, and the whites of eight eggs.

The spoiling of cloudy (muddy) wines may be prevented by an addition of sugar or boiled must.

XI.

ADULTERATIONS OF WINES.

Adulterations with poisonous substances, such as arsenic, lead, and copper, deserve especial consideration.

The sulphur used in curing the wine sometimes contains arsenic. The most simple way of ascertaining the presence of arsenic in the wine is as follows: Pour some of the white wine upon a piece of white paper, and draw through it with a piece of caustic stone (*lapis infernalis*). If the paper turns yellow the wine contains either arsenic or a phosphoric salt. If the color turns brown after a few minutes, or if the line appears harsh to the touch of the finger, the arsenic is certainly in it; if the color changes into a dirty green, there is nothing but the latter salt.

Lead and copper get into the wine if these metals were allowed to come in connection with it; for instance, by keeping it in copper vessels, or the presses having leaden parts, or not keeping the brass faucets clean. The lead is sometimes added to the wine by unscrupulous persons in order to improve it. This ought never to be done. Its presence is easily detected by the method of Mr. Hahnemann. He takes 4 parts of burned lime and 4 of sulphur (both finely powdered and conglomerated in a crucible over fire), dissolves them in 120 parts of pure water, and adds 3 parts of cream of tartar. In about a quarter of an hour the fluid turns milk-white. Now he adds a few drops of muriatic acid, and preserves the whole in closed bottles. It indicates the lead, even if there be only 1 part of it in 5800 parts of wine. The lead gives a black sediment.

Copper is found out in the wine by putting a bright piece of coin into it. If it contains copper, this will get metallically deposited on it.

Red wines are sometimes adulterated by the application of alum. It may be indicated by mixing the wine with *kalium.*

The earths and metallic salts fall to the bottom and remain. If the sediment is rubbed with a little grease, this gets metallic by this process, except in the case of arsenic, which evaporates, and makes itself known by a smell of garlic. The earths remain, and are cognizable by a solution in pure acetic acid. If this produces a salt of a bitter taste, it serves as a sign of the presence of lime parts; a salt of astringent taste shows argillaceous earth (clay). If it dissolves in reduced sulphuric acid, and gives a bitter salt, it contains magnesia.

Vitriolic acid is sometimes used for adulterating red wines. It may be known by their strong sour taste, or if their acids are satiated with lime-water, and the residue (or sediment) is greased. If it is cream of tartaric acid lime, it will become like burned

lime; if it is gypsum, it will be indicated by the smell of rotten eggs.

Frequently the wines contain mixtures of water, alcohol, sugar, honey, or a decoction of grapes or raisins. These are not detrimental to the health if the wine, after being mixed with them, has been allowed to remain quietly for some time, until a perfect combination has taken place. Wines of heavier body want two to three years, lighter ones a shorter period, but may be accelerated by warm cellars.

It is said that a mixture of sugar may be detected in a wine, if made shortly before, by turning an opened bottle of it over into a tumbler half filled with water. If it contains a sugar solution, this will transfer itself to the water and sweeten it. If the wine is sweet by nature, this is not the case.

Also the mixture of alcohol is indicated in this way: that if the wine is distilled, the alcohol changes already at 200° Fahr., while the natural alcohol will not before 212° Fahr.

The adulterations of the red wines are the most common. They are even frequently entirely fabricated in an artificial manner. The artificial coloring is generally in use even in the most renowned wine districts. For instance, Bordeaux imports yearly many thousands of dollars' worth of whortleberries solely for this purpose. Besides these, Brazil-wood is extensively used, the berries of the elder-tree, red beets, and flower of mallows.

According to Mr. Vogel, the natural red wine gives a greenish-gray sediment, that colored by elder-flowers and Brazil-wood an indigo-blue, by red beets a red sediment. An application of lime-water colors natural red wines yellowish-brown; those colored by Brazil-wood it changes into a reddish-brown; those by whortleberries and elder-flowers into green; those by red beets into a yellowish-white, but again into red by adding an acid.

An astringent taste is artificially given to the red wines by oak-wood-shavings or walnut-shells. In England they have a fashion of shaking a bottle with a decoction of Brazil-wood and cream of tartar to crystallize on its sides, in order to give artificial red wines the appearance of natural ones. The lower end of the cork stopper is also colored red.

Very common is a mixture of the grape wine with *apple wine* (cider). If it be good it can do no harm whatever, and is not easily recognizable.

XII.

USES FOR THE HUSKS AND SEDIMENT.

After the wine has been produced, there are remaining certain parts of the grape which may be turned to use. They may be classed as the husks and the sediment.

The Husks.

The husks consist of the pedicles and twigs of vines, and skins and stones of the grapes.

The *pedicles* and *skins* contain many astringent and acid parts, and have always more or less juice left in them after the crushing process has been gone through. They may consequently be used for making *brandy*, for vinegar, for *food* for animals, and as *manure* upon the fields. The stones may be used to make oil for tanning purposes, for coloring, and also instead of coffee.

If the husks are wanted for *brandy* they must be kept out of connection with the air, as by this they soon get sour and rotten; they must also be worked up soon. In the south of France they are put into large square copper kettles, that have a cooling-tube attached, and are put over the fire, when the brandy is formed.

Mr. Audouard recommends, however, not to distill them at all, but to extract the brandy by filtration, thereby gaining one tenth more in quantity, and an article of more strength and better taste.

The husks of 24 hogsheads of wine are put into three square stone vats, each of which has a faucet, and 24 barrels of water, each containing 200 kilogrammes, are added; and an hour later, the fluid is drawn off and distilled. It gives 72 kilogr. of alcohol of 22°, and a quantity of weaker spirit. Immediately after, the same quantity of water is again put to the husks, and the weak spirit added; an hour later, this fluid is again drawn off into the vat No. 1, and the same water put to them for the third time, which is drawn off into vat No. 2. The husks will then be found exhausted. Fresh husks are now filled in and extracted, (1.) by the fluid of vat No. 1, which then gives by distillation 100 kilogrammes of spirit of 22°; (2.) by the fluid of vat No. 2, which is then to be filled into vat No. 1; (3.) by pure water filled upon vat No. 2, and so on.

Vinegar is formed if the husks are moistened a little and left to ferment in closed tubs until the alcohol has been transformed into vinegar. This must then be drawn off from above by filtration.

If used for *food* for animals the husks must be thoroughly dried. Sheep like them exceedingly; poultry will especially thrive on them.

In making potash out of the husks, ten pounds will be the produce of 500 pounds of the husks.

If the stones are wanted to make oil of, they must be separated from the husks directly after being pressed, dried, cleaned by sieving, and then pressed; 100 lbs. of stones will give =10 to 12 to 20 lbs. of oil. The *oil-cake* forms an excellent food for hogs. In Italy, for instance, the single province of Verona manufactures yearly about 6000 cwt. of oil from these stones. They may also be used for tanning purposes, as they contain a great deal of the matter.

The Sediment.

The yeast matters that get deposited during the fermentation or later, contain, besides the yeast, mainly vegetable threads, cream of tartar, and other substances, as alcoholic and sweet ones. They may consequently be turned to profit by distilling brandy out of them. If burned, they make ashes very rich in alkali: 3000 pounds of dry wine yeast will give 500 pounds of ashes, which will yield 250 pounds of good potash.

The salts which are found deposited on the sides of the casks, especially of those containing old wines, are sold as "crude cream of tartar."

XIII.

THE CELLARS, CASKS, BOTTLES, AND IMPLEMENTS.

The Cellars.

Much depends on the condition of these. A good cellar should 1. *Lie toward the north*, because it is then less warm and less exposed to the changes of the temperature.—2. *Be deep*, to keep the influence of the outer air from it as much as possible.—3. *Be a little moist*, but not too much so. In such cellars a cask of 250 bottles will probably not lose more than one tumblerful a month, while in dry cellars frequently two bottles of wine and more will be lost.—4. *Have a moderate light.* If the light is too strong, it dries too much; if light is entirely shut out, mould is induced.—5. *Not be subject to shaking*, because each concussion injures the wine. — 6. *Not* be surrounded by a soil that contains *rotten or mouldy parts*, as these will fill it with bad vapors affecting the wine.—7. It must *not* serve at the same time *to keep vegetables, green wood*, or *vinegar, cheese*, etc.

A cellar that has not these required qualities may be improved by artificial means in the following manner:

1. If it is *too warm*, by planting trees about it where the sun shines upon it, or by fixing double doors at some distance apart, the inner one of which is not to be opened before the outer one has been closed. 2. If it is *too damp*, by putting the casks upon

a higher bed, and frequently sweeping the ground beneath them; or by making more air-holes; or by strewing fresh blacksmith cinders over the floor, and taking them out again after two or three days: these will absorb a great deal of moisture. 3. If it is *too dry*, by reducing the number of air-holes; by bringing in moist sand, or vessels filled with water. 4. If it is *too cold*, by warming it. This is especially advisable for red wines.

A cellar should have at least a height of six to ten feet, and be covered with six feet of earth. Cellars dug out of a gypsum rock can not be used during the first two to four years, as this evolves a vapor which might spoil the wine in the casks. Air-holes are indispensably necessary, and must, during the summer heat, be lightly covered over with straw, as also during the cold of the winter.

In order to get the carbonic acid, so detrimental to the health, out of a cellar, some slackened lime must be introduced, besides keeping up a good draught of air. If a person has business in such a cellar, a lighted candle ought always to be taken along, and held low. When it goes out of itself there is danger of suffocation. This may be in some measure prevented by holding a sponge dipped in ammonia before the mouth and nose.

The Casks.

Large casks are preferable to small ones. The fermentation takes a more even and perfect course in them; the air has less influence on the wine, which is not so liable to sudden changes, on account of the greater thickness of the staves. After they are filled they are to be closed air-tight by bungs, made best of ash-wood, and have a small hole left in the middle, which serves to fill the wine up through. The bung of this hole has a hook to facilitate its lifting.

According to experiments made by Mr. Lignieres, the wine in ordinary barrels loses, in the first year, from 8 to 10 per cent.; but in large casks, on the contrary, only 1½ per cent. Besides this, there are other advantages offered by large casks. They cause a saving of room and of labor.

In olden times large casks were constructed, where frequently single cloisters and seigneuries had occasion to bring the rich harvests of entire districts into their cellars. The most widely-known of them were:

1. The great cask of Kœnigstein, in Saxony. It is 17 ells long, its depth is 12 ells at the bung and 11 ells at the bottom. It was constructed in the year 1725, and has 157 staves, each one 8 inches thick. It holds 3709 Dresdener eimer of wine. The wine with which it was filled the first time cost 20 kreutzers per maas; altogether, 50,000 guldens.

2. The great cask of Heidelberg, in Germany. This is 36 feet long, 24 wide, and 21 high. A staircase leads up to a small danc-

ing-room. The iron hoops weigh 110 cwt. It was constructed in the year 1664, and holds 2040 eimer of wine—236,000 bottles. In the same cellar is shown, as a contrast to this leviathan, a very small keg, only holding a few drops.

3. The big cask of Nikolsburg, in Moravia. It holds 2000 eimer, and has 22 iron hoops, each of which weighs 7 cwt. It was constructed in the year 1643.

4. The cask at Tata or Dotis, in Hungary. This holds 1500 eimer; is 24 feet long, and 14 high; has staves 6 inches thick, and enormous iron hoops, held together by iron screws as thick as one's arm. By means of a ladder the bung-hole is reached. The cellar in which it is placed holds 50,000 eimers of wine, and one may drive about in it with a coach and six.

5. The cask of Kloster Neuburg. This holds 999 eimer. Besides these, the bung-hole holds a full eimer.

6. The cask in the castle at Tübingen, which is 24 feet long and 16 high. Constructed in 1548.

7. The casks on the island of Meinau, in the Lake of Constance. The largest one holds 184,320 bottles. Besides this there are 100 others, each one capable of holding 5000 bottles.

8. The cask at Grœningen, constructed by Michael Werner, who built also the one at Heidelberg. It consists of 93 oak staves, each one 30 feet long, and 8½ inches thick at its end. Each bottom is 18 feet and 1 inch high, and has 3 bars. Each hoop is 9 inches thick, made of oak, with iron bands and screws. On all the hoops are 316 pairs of bands, and 955 iron screws, which weigh together 123 cwt. 99 lbs. It is said that the weight of the cask itself is 636 cwt. 18 lbs., and that it holds 161 fuder and 16 viertel, or 28,672 stübchen of wine. Its cost, without including the value of the timber, was 6000 thalers.

The Bottles.

In order to clean the bottles, common lead shot is usually used; but this may become detrimental to the health, because every time they are used some lead remains on the glass, and even single shots, that get dissolved and poison the wine. To extract such pieces there is an instrument called the "lead extractor." This consists of a steel rod with a handle, and at its lower end a crooked or bent point to loosen the shot with; and a little above this, a hook to extract the pieces of cork that may be in the bottle. It is, however, better to use common coarse sand or small iron chains for the purpose of cleaning bottles.

Bottles that have been used before must be cleaned very carefully before they are filled anew. If there has been pitch or wax on them, these must be removed by a knife, or an instrument called the "*pitch remover.*" This is formed by two teethed steel jaws, movable in a hinge, and held by a handle with one hand. This is pressed asunder in order to get the neck of the bottles between

the jaws, and the instrument is then turned round. The pitch now falls directly off. In about half an hour it can clean 100 bottles, that would otherwise occupy two or three hours.

The filled bottles are placed in the cellar either upon sand or laths, one above another, three to five feet high, in a horizontal position, so that the cork shall be always covered by the wine.

Corks and Corking.

It ought to be a rule always to take only the softest, most equal corks, and those that have the fewest holes. For wines that are to be kept for a long time new corks must be taken. The lower end of the corks, before putting them into the bottles, must be pressed a little.

Sealing and Capping.

Sealing is generally preferred for fine wines. The neck of the bottle is for this purpose dipped into the molten sealing-wax or pitch, and then put upright to let this get cold. In France they usually make this wax by melting together two pounds of pitch, one pound of Burgundy pitch, half a pound of yellow bees'-wax, or six ounces of tallow and half a pound of red mastic, which is sufficient for 300 bottles; or two pounds of white pitch, one pound of rosin, and a quarter of a pound of bees'-wax.

The putting of lead or tin foil over the corks is not quite as advisable a manner as the foregoing.

XIV.

WINE MEASURES OF ALL COUNTRIES.

[*The following Wine Measures have been reduced to Parisian cubic inches and decimal parts.—Cub. denotes cubic inches.*]

Aachen (Aix-la-Chapelle) has the Prussian measure. The old wine-can (kanne)=1066 litre.

Alessandria (Sardinia).—1 caro = 10 brente = 360 pinte = 720 bocali=1440 quartini=28.400 *cub.*=8795 Bavarian eimer=564 litre.

Alicante.—1 tonnelade=2 pipes=80 arobas=100 cantaras= 54.400 *cub.*=1079 litre=16.8 Bavarian=15.7 Prussian=18.6 Vienna eimer. The cantara=8 medios=16 quartillos.

Altenburg.—1 eimer=40 cans=80 maas=160 nössel=3419.9 *cub.* = 67 litre = 1057 Bavarian = .987 Prussian = 1169 Vienna eimer.

Altona.—1 ahm=4 anker=5 eimer=20 viertel=40 stübchen =80 kannen=160 quartier=320 oessel.

Amsterdam.—French measure: the vat=100 litre.

Ancona.—1 soma = 48 boccali = 3455 *cub.* = .9977 Prussian eimer.

Appenzell.—1 eimer = 32 maas = 2112 *cub.* = 41.8 litre.

Arau.—1 saum of unclear measure = 108 maas; 1 of clear measure = 100 maas; 1 saum = 100 maas = 2245 Bavarian eimer = 144 litre = 31.706 gallons = 1898 Leipsic, or 2096 Prussian, or 2482 Vienna eimer.

Baden (Grand Duchy).—1 ohm = 10 stützen = 100 maas or 1000 glasses; since 1810 French measure.

Barcelona.—1 carga = 16 cortanes = 32 quarteros = 128 quartos = 5505 *cub.* = 109 litre.

Basle.—1 saum = 3 ohm = 96 old = 120 new maas = 7404 *cub.* = 146 litre = 1.014 Hamburgh ahm.

Bavaria (Kingdom).—1 schenk-eimer = 60 shenkmaas = 3235.53 *cub.* = .4283 French litre = .4283 Danish ahm = .4429 Hamburgh ahm = .8455 Leipzic = .9336 Prussian eimer = 5.0523 Russian wedro = .4082 Swedish ahm = 1.1055 Vienna eimer.

Bern.—1 landfass = 6 saum = 24 brenten = 600 maas; 1 saum = 4 brenten = 100 maas = 400 viertel = 167.12 litre = 505.13 *cub.*

Bilbao.—1 cantara (aroba-major) = 8 acumbres = 32 quartillos = 794 *cub.* = 15.7 litre.

Bologna.—1 corba = 60 boccali = 240 fogliette = 3720 *cub.* = 73.7 litre = 1.15 Bavarian = 1.074 Prussian eimer.

Bordeaux (France).—1 tonneau = 4 barriques = 6 tierces = 128 veltes; 1 barrique = 228 litre = 3555 Bavarian = 3319 Prussian = 3931 Vienna eimer.

Braunschweig (Brunswick).—1 fuder = 4 oxhoft = 240 stübchen = 960 quartier = 1920 noessel; 1 oxhoft = 1111 *cub.* = 22 litre = .343 Bavarian = .32 Prussian eimer.

Bremen.—1 ahm = 45 stübchen = 180 quarts.

Cassel.—1 ohm = 80 maas = 8033 *cub.* = 2.1 Leipzic eimer = 1.1 Hamburgh ahm = 159 litre = 35 gallons = 2.31 Prussian eimer.

Constantinople.—1 alma = 264 *cub.* = 5.2 litre = 1.1 gallon = .09 Vienna eimer.

Corunna.—1 mojo = 4 canadas = 16 allas = 68 acumbres = 272 quartillos = 5440 oncias = 6749 *cub.* = 133.8 litre = .924 Hamburgh ahm = 2.087 Bavarian eimer.

Cracow.—1 bezka = 34 garnico = 144 kwart = 6883 *cub.* = 2.128 Bavarian = 1.799 Leipzic = 1.987 Prussian eimer = 30.06 gallons = 136.5 litre.

Darmstadt.—1 ohm = 20 viertel = 80 maas = 320 schoppen = 8065.9 *cub.* = 2.49 Bavarian = 2.1 Leipzic = 2.328 Prussian eimer = 35.2 gallons = 160 litre.

Debreczin (Hungary).—1 big czeber = 100 Hungarian ize = 4201 *cub.* = 83.3 litre = 1.908 Leipzic eimer; 1 small czeber = 50 Hungarian ize = 41.6 litre.

Denmark (Kingdom).—1 fass = 7½ ahm = 30 anker; 1 fuder = 6 ahm = 24 anker = 240 stübchen = 465 cans = 930 pots = 3720

pale; 1 ahm=7548.5 *cub.*=32.9665 gallons=149.73 litre=2.1794 Prussian eimer.

Dresden.—1 eimer=63 cans=126 noessel=504 quartier=2973 *cub.*=1.016 Vienna eimer.

England.—1 imperial gallon=4 quarts=228.974 *cub.*=.0708 Bavarian eimer=4.54 litre=.0661 Prussian eimer.

Ferrara.—1 mastello=8 secchie=4128 *cub.*=18.02 gallons=81 litre=1.079 Leipzic eimer.

Florence.—1 barile=20 fiashi=40 mezzetti=2298 *cub.*=10.03 gallons=45.5 litre.

France.—1 kilalitre = 1000 litre = 50412 *cub.*; 100 litre = 5041.24 *cub.*=1.5590 Bavarian=1.3182 Leipzic=1.4555 Prussian =1.7236 Vienna eimer=.6678 Danish ohm=22.0566 gallons.

Frankfort on the Main.—1 ohm=20 viertel=80 old maas=320 old schoppen=7230 *cub.*=2.08 Prussian=2.47 Vienna eimer=.95 Danish ohm=31.57 gallons=143 litre=.99 Hamburgh ahm; 1 stück ohm=8 ohm and 1 viertel=19.9 Vienna=18 Bavarian= 16.8 Prussian eimer=1154 litre=1 fuder=6 ohm.

Freiburg (Switzerland).—1 fass=16 brente=400 maas=1600 schoppen=1970 *cub.*=39 litre=.515 Leipzic eimer.

Fulda.—1 ohm=2 eimer=80 maas=320 schoppen=7282 *cub.* =146 litre=1.009 Hamburgh ohm.

Geneva.—1 char=12 setiers=576 pots=27648 *cub.*=548 litre.

Genoa.—1 mezzarola=2 bariles=200 pintes=7484 *cub.*=148.4 litre=32.68 gallons=1.025 Hamburgh ahm.

Glarus.—1 eimer=4 viertel=30 kopf=60 maas=240 stozen= 5382 *cub.*=106.7 litre.

Gratz.—1 startin=28533 *cub.*=9.756 Vienna=8.82 Bavarian eimer=566 litre=3.9 Hamburg ahm.

Hamburgh.—1 ahm=7300.05 *cub.*=2.2576 Bavarian eimer= .9670 Danish eimer=31.8815 gallons=1448 litre=2.1077 Prussian eimer; 1 fuder=6 ahm=24 anker=30 eimer=120 viertel =240 stübchen=480 cans=960 quartier=1920 oesel; 1 fass of wine=4 oxhoft=6 tiercen; 1 oxhoft of brandy=60 stübchen.

Hanau.—1 ohm=20 viertel=80 maas=320 schoppen; 1 ohm old measure=7522 *cub.*, new measure=6488 *cub.*

Hanover.—1 fuder=4 oxhoft=6 ahm=15 eimer=24 anker= 240 stübchen=480 cans=96 quartier=1920 nössel; 1 ahm= 7840 *cub.*=155.5 litre.

Lausanne.—1 char=400 pots=23444 *cub.*=465 litre=6.769 Prussian=7.25 Bavarian eimer.

Leipzic.—1 oxhoft of French wine=2⅝ eimer; 1 fuder=2.4 fass=12 eimer=24 ahm; 1 eimer=63 cans=126 nössel=504 quartier=3824.1 *cub.*=16.7009 gallons=75.85 litre=1.1041 Prussian eimer.

Lemga.—1 ohm=108 cans=7851 *cub.*

Lubeck.—1 fuder = 6 ahm = 120 viertel = 240 stübchen = 480 cans=960 quartier=1920 planken=3840 ort. The ahm is equal to that of Hamburgh.

Lucerne.—1 saum=$3\frac{1}{2}$ ohm=100 maas=400 schoppen=4000 primen=8712 *cub.*=172.8 litre=38.04 gallons=2.515 Prussian eimer.

Madrid.—1 moja=16 cantaro; 1 pipe=27 cantaros; 1 rotta=30 cantaros.

Mahon.—1 carga=26 quarteras=5096 *cub.*=101 litre.

Mailand.—1 somma=10 mine=100 pinte=1000 koppi=100 French litres.

Malaga.—1 pipe de Pedro Ximenez wine has =354 litres=6.1 Vienna eimer=5.52 Bavarian eimer=78.01 gallons=2.447 Hamburgh ahm=5.157 Prussian eimer.

Messina.—1 salma=8 quartari=12 quartucci=4416 *cub.*=87.59 litre=1.509 Vienna eimer.

Napolis.—1 parile=2109 *cub.*=.751 Vienna=.634 Prussian eimer=43.6 litre=9.6 gallons.

Neufchatel (Switzerland).—1 muid=5 gerle=12 setiers=192 bot=13047 *cub.*=250.8 litre=4.035 Bavarian eimer.

Oedenburg.—1 ako=84 Hungarian halbe=3529 *cub.*=70 litre =1.2 Vienna=1.09 Bavarian=.92 Leipsic=1.019 Prussian eimer.

Oldenburg (Grand Dukedom).—1 anker=26 cans=40 quartier =1924 *cub.*

Osnabruck.—1 ahm=6887 *cub.*; 1 fuder=6 ahm=168 viertel =672 cans=2688 ort=10752 helshen.

Oviedo.—1 cantaro=925 *cub.*=18.3 litre=.316 Vienna eimer.

Palma (Island of Majorca).—1 carga=26 quarteros=5096 *cub.* =101 litre.

Poland.—1 beczka=25 garnice=100 kwarti=100 French litre.

Portugal (Kingdom).—1 fuder=2 pipas (batas)=52 almudes=104 alquieras (potas)=624 canhados=2496 quartilhas=43888 *cub.*=12.671 Prussian eimer=191.67 gallons=870.5 litre=6.012 Hamburgh ahm=15.005 Vienna eimer.

Presburgh.—1 eimer=64 Hungarian halfs=2689 *cub.*=.776 Prussian=.831 Bavarian eimer=11.74 gallons=53.3 litre=.368 Hamburgh ahm.

Prussia (Kingdom).—1 eimer=60 quart=3463.42 *cub.*=1.0711 Bavarian eimer=15.1258 gallons=68.70 litre=.4744 Hamburgh ahm=.9056 Leipzic eimer=1.1841 Vienna eimer.

Rome.—1 botta=3 brente=9 barili=$40\frac{1}{2}$ rubbi=228 boccali =1152 fogliette=20649.7 *cub.*=409.6 litre=7.06 Vienna eimer; 1 barilo=$4\frac{1}{2}$ rubbi=32 boccali=128 foglietti=512 cartucci=2294 *cub.*=10.02 gallons=45.5 litre.

Rostok.—1 ahm=4 anker=5 eimer=20 viertel=40 stübchen =80 cans=160 pot=.999 Hamburgh ahm; 1 fuder has =4 oxhoft or 6 ahm.

Russia.—1 fass=$13\frac{1}{3}$ anker=49 wedro=160 tschetwerki=368 osmuschki or kuschki. The wedro has 640 *cub.*=2.7950 gallons =12.69 litre=.1847 Prussian eimer.

St. Gallen.—1 eimer=4 viertel=32 maas=128 schoppen=2576

cub.=51 litre=.88 Vienna=.796 Bavarian=.743 Prussian eimer. The must eimer has 36 maas. The fuder=7½ saum or 30 eimer.

Schaffhausen.—1 saum=4 eimer=16 viertel=128 maas=2120 *cub.*

Siebenbürgen.—1 ur=570.6 *cub.*=11.3 litre=.164 Prussian eimer.

Solothurn.—1 saum=100 maas=8033 *cub.*

Sweden (Kingdom).—1 ahm=7920 *cub.*=2.4493 Bavarian=2.2867 Prussian=2.0710 Leipzic eimer=34.5892 gallons=157.50 litre=1.0849 Hamburgh ahm=12.3754 Russian wedro=1.0492 Danish ahm; 1.25 Swedish tuns=2.7079 Vienna eimer; 1 fuhre of wine is =2 pipen=4 oxhoft=6 ahm=12 eimer=24 anker=360 cans=720 stoop.

Tokay (Hungary).—1 fass=2¾ Presburg eimer=176 Hungary halfs=7395 *cub.*=2.528 Vienna=2.287 Bavarian=1.933 Leipzic =2.135 Prussian eimer=146.6 litre=32.29 gallons.

Trieste.—1 orna=36 boccali=3310 *cub.*=65.6 litre=1.13 Vienna eimer.

Tyrol.—1 ihre=12 pezeiten; 1 pezeite=4½ maas; 1 maas=4 seidel; 1 ihre=2240 *cub.*=.646 Prussian=.765 Vienna eimer =9.78 gallons=44.4 litre.

Valencia.—1 carga=15 arobas (cantaras)=60 accumbres=8594.8 *cub.*=2.938 Vienna=2.658 Bavarian=2.481 Prussian eimer=170.49 litre=37.53 gallons.

Venice.—1 biconzia=¼ amphora=2 conzi=128 boccali=7995.8 *cub.*=158.6 litre.

Vienna.—1 eimer=41 maas=2924.7 *cub.*=.9044 Bavarian eimer =12.773 gallons=58.01 litre=.4006 Hamburgh ahm=.7648 Leipzic=.8444 Prussian eimer=4.5698 Russian wedro=.3692 Swedish ahm.

Wallachia.—1 viadra=10 oka=713.34 *cub.*=14.15 litre=.2439 Vienna eimer.

Weimar.—1 eimer=80 maas=3695 *cub.*=73.3 litre.

Wiesbaden.—1 ohm=20 viertel=80 small maas=2.113 Bavarian=1.073 Prussian eimer=6824 *cub.*

Würtemburg (Kingdom).—1 eimer (hellisch-maas)=160 maas=14817 *cub.*=4.582 Bavarian=3.874 Leipzic=4.278 Prussian eimer=293.9 litre=64.71 gallons=5.066 Vienna eimer. The fuder has 6 ohm or eimer; 96 immi=960 maas, 3840 schoppen.

Zürich.—1 saum=1½ eimer=6 viertel; 1 viertel=8 kopf=16 maas=32 quartli=64 stozen; 1 eimer (clear measure)=4 viertel =60 maas=120 quartli=240 stozen=5520 *cub.*=109.5 litre.

Old Roman Wine Measures.—1 cubeus=20 amphora (or 513⅓ litre); 1 amphora=2 urnas=8 congius; 1 congius=6 sextarius =12 hemina=24 quartarius=48 acetabulum=72 cyathus=208 ligula (=3⅕ litre).

APPENDIX C.

IMPROVEMENTS IN WINE-MAKING.

EXTRACTED FROM DR. L. GALL'S "DIRECTIONS TO IMPROVE THE QUALITY AND INCREASE THE QUANTITY OF WINES; ALSO, TO MAKE GOOD WINES FROM THE HUSKS OF GRAPES."—TRIER, 1861.

WITH ILLUSTRATIONS.

APPENDIX C.

DR. L. GALL ON IMPROVEMENTS IN WINE-MAKING.

I. Grape-sugar.—II. The Grape and its Components.—III. *Methods of Picking Grapes:* At Castle Johannisberg. Mr. J. A. Ackermann's Method. Mr. S. Hörter's Method. Messrs. Buhl, Jordan, and Wolff's Method. Method used in Tokay and Syrmia. Relative Value of perfectly Ripe Grapes. Benefits from Selecting. Benefits from perfect Maturity.—IV. Progress of Wine-making to the Middle of this Century, illustrated by Examples.—V. *Principal Contents of the Grape necessary for the Fabrication of Wine:* Water. Sugar and the Must-Scale. Artificial Grape-sugar. Acids and the Acid-Scale. Salts. Gummy Parts. Coloring Matter. Nitrogenic Parts. Flavoring Matters. Extractive Matter.—VI. Wine Fabrication since 1850: Gall's Procedure and Improvements. VII. Gall on Reformations in Wine-making.—VIII. Preparations for the Vintage.—IX. *Occupations in the Press-house:* Manner of Extracting. Improving the Natural Product.—X. Dübrunfaut and Petiot's Method of increasing the Quantity of Wines. Gall's Experiment on Petiot's System. Application of the Extractor to Petiot's Method.—XI. *Fermentation and its Products:* In a high Temperature. Close Fermentation. The Alcohol. The Vaporimeter. Carbonates. Ether. Acetic Acid. Barrel Yeast. XII. Husk Wine Fabrication according to Cadet de Vaut and Gall.—XIII. *Care of Wines, and their Diseases:* Mould. Sliminess. Sourness. Cloudiness. Woody and Mouldy Taste.—XIV. Supplementary Remarks.

I.

GRAPE-SUGAR.

At an exhibition of different grape wines, held at the city of Karlsruhe in the year 1849, a cask of the vintage of 1847, from the celebrated cellar of Baron de Babo, was unanimously declared the finest of that year's growth, although the Board of Commissioners were well aware of the fact of its superiority being mainly attributable to the employment of "*Chaptal's method of improving the must*" (the so-called "*Chaptalizing method*"); *i. e.*, a mixture of sugar before the fermentation takes place.

At the same time, it was no longer a secret that, in France, such a mixture of sugar was not only actually customary, but also the almost exclusive use of *artificial* "grape-sugar," which, being only half as dear in price, is, moreover, considered better than common sugar, because of its chemical composition being the same as that of the *natural* grape-sugar. This procedure of Mr. de Babo having been openly acknowledged, the firm of Messrs. Best Bros., at Osthofen, on the Rhine, were induced to erect in the same year, 1849, their first manufactory of grape-sugar after the French method. In the year 1850 I published, for the first time, my essay on the method of producing a very good quality of medium wines from grapes yet unripe, since known as Gall's method.

The main feature of the difference between *Gall's* and *Chaptal's*

methods lies in the first requiring twice, or even three or four times as much sugar as the latter, producing, however, from the same quantity of must, from ten to fifteen, or even a hundred per cent. more wine, and that of much better quality, and especially more durable and more agreeable to the taste.

The splendid success attending the first enterprise of Messrs. Best Bros. induced Mr. Friedrich Wohl, of Neuwied, to erect, in the year 1852, another establishment, on a still larger scale, at Neuwied; and as early as 1853 several others followed, by various parties, all of them enjoying a high reputation for their articles, and commanding a ready and profitable sale of them. Since then, year by year, other similar establishments have been founded, and now there are no less than seventeen in successful operation.

We have to refer here to two circumstances: 1. That the first grape-sugar factory had to be enlarged in 1825, after Gall's method had become known prior to the fall of 1850, the poorest vintage on record of the century in regard to quality of the wine itself; which method, requiring an addition of water to reduce the acids of the "must," makes also a larger portion of sugar necessary than Chaptal's method. 2. That the founders of all the following establishments were only induced to the enterprise by the great success of the former, and the demand for "grape-sugar" grew successively from year to year.

From this it appears that the grape-sugar factories prove, by their very existence and the history of their founding, that, 1. They were called to life by the scientific advances made in the fabrication of wines. 2. That the improved system of wine fabrication has gained ground from year to year. 3. That the results of the same have given entire satisfaction to the grape-growers and wine-dealers. 4. That these have considered it most useful, after the experiments made from 1850 up to 1856, even in 1857 and 1859, to improve, by an addition of artificial means, partially even of nothing but sugar, what Nature had failed to make good in quality.

In this way, the advancing science in the fabrication of wine has, in its onward march through the grape-cultivating districts of Germany, built up evident monuments of its pacific conquests which would put to shame even its most inveterate enemies.

The firms of these "Grape-sugar factories" are:

In Prussia: Friedrich Wohl, Remy & Wohl, and N. Reinhardt, at Neuwied; H. T. Bertog, Lohburger Fabrik, and Jachling & Co., at Magdeburg; A. Rammelberg, at Wolmirstedt; C. J. Knoelke, at Frankfort on the Main; Baron von der Deken, at Dziewentline, in Silesia. *In Rhenish Hesse:* Tobias Diesz & Co., at Offstein; N. Hoffmann, at Ingenheim; Fritz Muth & Weisheimer, at Neumuehl. *In Baden:* Albert Glock, at Karlsruhe. *In Würtemburg:* Adolfsfurter Fabrik, at Oehringen. *In Austria:* Carl Hesse, at Primislaw, Bohemia; Carl Henn, at Hochenegg, Styria.

II.

THE GRAPE AND ITS COMPONENTS.

The general appearance of the grape being universally known, it needs no farther description in this chapter. We shall therefore confine ourselves to show which of its interior parts contributes most to produce a palatable and durable wine.

As all-wise Nature has provided every species of plants with constituent parts, whereby they are enabled to germinate, grow, and draw their necessary nourishment, so the fruit contains certain elements which are required for the first support of the future plant; these, therefore, are not only useful, but indispensable to their own offspring, though not always so for the application to man's taste and purposes. For instance, each grain of barley contains, besides starch, albumen, sugar, gum; also oil, water, phosphate of lime, and mucus; and all of these matters are eminently necessary for the production of the roots, stalk, leaves, flowers, and fruits of the new barley plants. But for producing the beverage called beer, man only uses the three first ingredients; and for the fabrication of malt whisky or alcohol out of barley or any other species of grain, absolutely no other is of any value but the starch. In the same manner, man only makes use of the sugar matter which he draws out of the sugar-beet for the making of the sugar itself, leaving aside all the other ingredients contained in the plant.

The same may be said of the grape. Of its perhaps twenty different ingredients, some—if the fermentation of the must takes place in a fully-filled cask—will be cast out at the very beginning of the fermentation; others while it is going on; and others in a shorter or longer period afterward; and some will even "settle" after a number of years have passed. These ingredients, therefore, do not belong properly to the main produce of the grape—the wine. They form no constituent part of it; they were only necessary for the nourishment of the new plant emanating from the seed.

Therefore it is evident that only the grape itself is a product of nature. The wine, however, or the art of making it—be the quality good or bad, according to that of the grape, or his knowledge to prepare its juice—is one which only an accident could teach to man; to improve which, only other accidental observations, reflections, and various alterations could lead him.

Only very lately, however, after groping about in the dark for more than a thousand years, man—guided by the hand of progressing natural science—has discovered that it was his own fault if he could only produce from grapes not yet fully ripe another but very inferior quality of wine. It only depends on him to

make the best possible wines out of grapes fully ripe, after throwing out the unripe and damaged ones; the same as it does on himself to produce from grapes not seasonable yet a wine of very good quality, by adding such ingredients as are necessary to the fabrication, comparing them to those of the ripe fruit.

The grape-fruit, from its blossoming to maturity, has to go through three distinct terms:

1. The Formation.
2. The Growth.
3. The Maturing.

During the last the formation of the sugar stuff takes place, which afterward produces, by the wine-making process and fermentation, the alcohol—the spirit that gives the juice its strength and fire.

In some very favorable years may still be added,

4. The Refining.

This, however, is but seldom attained by all berries of a grape, and never by all the grapes of one and the same bush, except by the application of artificial means.

The refining period takes place at the expiration of the life of the berries, when the small pedicles which unite them to the main one dry up, and do not allow any farther circulation of the sap. Then begins a partial evaporation of the watery elements, the sugar element in the mean time remaining unchanged. The juice, hereby excluding farther sugar formation, gets, by concentration, sweeter—therefore improving. The same result is achieved in France, Spain, Portugal, and Italy, where it is even customary, by giving the pedicles or stalks of the grape a full twist at the time of maturing, and allowing the grapes to hang on the bush after this as long as possible.

Still another point needs remark, tending to show the policy of leaving the grapes hanging—the longer the better. The better to appreciate the importance of it, however, we shall have to look a little closer into the structure of the berries.

Take, for instance, a healthy berry; open the inside by a cross-cut, and you will seemingly behold a sort of jelly surrounding the seeds. By a closer look, however, we see distinctly *fibres*, which cross each other in different directions. These fibres form the partitions between numerous small *cells*. In the berries not yet matured, various acids, as acids of apples, wine, grapes, etc.; bitartrate of potassa; some traces of salts, albumen, and water, form the entire contents of these cells. By the maturing process of the fruit, "grape-sugar" is formed from the elements of the fibres and a part of the superabundant acids and water.

This change first takes place on the surface of the berry, underneath the skin, and develops itself, on account of the exterior warmth which causes the maturing, only gradually toward the centre. Here we have the reason why the juice of berries not

yet fully ripe tastes sweet on their surface below the skin, while toward the centre the grape contains a jelly more or less sour, according to the state of maturity.

Besides what we have now seen—the partial formation of the sugar from acids—the inner structure of the berry may also teach us the manner to obtain the sweet juice suitable for wine-making, separated from the sour and bitter stuffs.

It is a well-known saying that a wine without acids is neither palatable nor durable; but every thing must be confined in a certain measure, and this measure we find the best in the natural combined state of sweet and sour stuffs within the completely ripened grape. Witness those wines, known as "Selected Grape Wines" of the Palatinate, that brought, even in 1852, which was considered as only a medium year, from 5000 to 8000 guilders per cask—being pressed from "*selected berries.*" Witness the "Johannisberg Cabinet Wines," that fetch as high as 11 guilders per bottle—made up from "*selected berries.*"

If, therefore, the berries, selected with the greatest care, already contain a sufficient quantity of acid and sour stuffs to produce the most costly and durable wine, it seems clear that the grapes picked in a mass, of the best year's growth, contain too much acid; and in order to produce as good a wine as the quality of the grape permits, it appears necessary not to mix the must of the last pressure with that of the former even during the pressing process. Nature itself shows us this in retaining the impure juice, only apt to spoil the sweet pure one, so tenaciously by the meshes of the cells, and the texture of the skins and pedicles of the berries.

We have, indeed, to acknowledge the want of a definite standard—so long as it was not generally understood that the value of the *middle wines* chiefly depended on a certain quantity of acids—by which to regulate the mixture of the must of the different pressures. Formerly, also, it was not understood how to dispose of the sour juice of the last pressure in conjunction with the good must; but now we claim to know these standards.

No experienced wine-grower ought to be unacquainted with the "Essays" of Dr. Lüdersdorf, who gave us, as early as 1841, the important hint, that the "*good quality, state of flavor, and price of the wines depends infinitely more on their not too large amount of acids, than on a high grade of alcohol.*"

In even the most favorable years the state of perfect maturity is but seldom attained, and in inferior and middling years the sugar process is never entirely interrupted during the continuation of vegetation. Considering, therefore, that the good quality of the grapes—*i. e.*, their aptitude for wine-producing—is more based upon a certain medium quantity of acids than upon a large quantity of sugar, and that this same sugar is partially formed by the acids already contained within the berries, without their being too much reduced thereby; that evidently with each addi-

tional day the grapes are allowed to hang on the bush, the sweetness increases while the acid diminishes, it must clearly appear, even to those not interested in practical grape-growing, that the best and true policy would be always to wait for the highest possible state of maturity to gather in the grapes, provided that the state of the weather be favorable enough.

It seems rather singular that while every one breaking off fruits always selects for his choice principally the most luscious ripe ones, leaving the remaining cherries, apples, etc., to mature, yet in regard to grapes—this superb fruit, whose culture is so tedious and expensive, whose thriving and sale affects materially the welfare of entire populations—it has almost remained customary to gather together bad and good, ripe and unripe, and throw them all in one heap.

No other fruit, however, matures so irregularly as the grape. The difference of soil, the declination, the temperature, the kinds of seed, the treatment, the site, and the age of the stock, affect more or less the period of maturity. Even on one and the same bush the grapes will ripen the sooner the nearer they are to the ground; and even in the same cluster one finds berries in different states of maturity.

In what manner, therefore, shall we proceed in gathering the grapes—a labor which Nature has imposed upon man—in order, at least, to produce as good a wine, even in inferior years, and this without any mixture, pure as nature gives it, as the best years' vintages may enable us to produce?

This question we will answer in the next chapter by a few illustrations, which, although long known, are yet but little regarded.

III.

METHODS OF PICKING GRAPES.

I PROCEED to describe the means of producing wines of prime quality, even from inferior vintages, without the aid of artificial means, beginning with a few examples of the mode of picking the grapes, as practiced in celebrated vineyards.

Method practiced at Castle Johannisberg.

Here the gathering of the grapes begins as late in the season as possible, in order to give them plenty of time to attain their fullest maturity. It takes place usually in November, frequently, however, not before the first fall of snow, and only in very good years in the month of October. The care expended upon the vintage itself, and the treatment of the wine, is undoubtedly one of the main causes of the superior quality of the article. The

gatherers employed are strictly forbidden to eat of the grapes, under penalty of instant dismissal, but they receive double wages during the time of vintage. None but absolutely matured grapes receive the honor of being thrown under the press, and many a bush is not emptied until the fourth turn. Warm and dry weather is considered essential in the fall.

For the finest "Select Wines" (*Auslese Wein*) only the most luscious grapes are picked out, and from these the best-matured berries are cut out singly by the scissors. After "musting" them for 24 hours they are taken to the press.

Since the vintage of the year 1800, have been produced at the Castle Johannisberg,

18 times wine of inferior quality;
16 times wine of good quality;
7 times wine of prime quality;
5 times wine of superior quality.

The "superior" wines were of the vintages 1811, 1822, 1831, 1834, and 1846. The wine of 1831, however, bears off the palm from all others. In 1817, the wine was absolutely bad; in the year 1816, the grape-bushes were killed by the frost, so that no vintage took place. The richest yields were those of 1811, when 46 acres of vineyard produced 50 casks; of 1819, when 45 acres produced 52 casks; and of 1833, when 55 acres produced 57 casks per acre. On an average, from the year 1800 to 1849, 50 acres of vineyard were annually under cultivation, and the produce of each acre during this period was 34 casks. One cask of wine is equal to 80 Prussian maas, or 160 French litres. One acre is about equal to three fourths of a Prussian morgen.

The wine of remarkably superior vintages is sold by the bottle; the other qualities are generally sold by the cask, at public auction. The highest prices paid were as follows:

In 1802,	for one	cask of	the vintage of	1777,	5,000	florins.
"	"	"	"	1780,	4,500	"
"	"	"	"	1781,	4,000	"
"	"	"	"	1794,	3,500	"
"	"	"	"	1798,	2,700	"
"	"	"	"	1791,	2,200	"
"	"	"	"	1793,	2,000	"
1805,	"	"	"	1825,	6,500*	"
"	"	"	"	1825,	9,100†	"
1832,	"	"	"	1822,	12,500‡	"

The "*Cabinet Wine*," *i. e.*, the kind sold only in bottles, brings the following prices, according to the Price-current of 1847:

Vintage of	1822,	sealed with	gold	wax,	17 *fl.*, 32 *kr.*
"	1831,	"	silver	"	7 "
"	"	"	green	"	4 "
"	1834,	"	gold	"	7 "

* To Mr. Von Rothschild. † To the King of Bavaria. ‡ To the King of Prussia.

Vintage of 1834,	sealed with	red	wax,	4 *fl.*	
"	"	yellow	"	2 "	30 *kr.*
" 1842,	"	gold	"	4 "	
" "	"	red	"	4 "	
" "	"	blue	"	2 "	
" "	" (*Ausbruch*)	blue	"	11 "	

Professor Von Liebig subjected the wine of Castle Johannisberg to a chemical analysis, of which the following shows the results:

Vintage.	Per Cent. of Alcohol. By Measure.	By Weight.	Sugar and Not-volatile Contents, in 100 Parts.
1822	13.63	10.80	3.300
1831	13.63	10.80	2.692
1834	14.39	11.40	2.654
1839	15.90	12.90	3.470
1842	15.90	12.60	3.755
1845	15.90	12.60	5.030

Method of Mr. J. A. Ackermann.

Mr. Ackermann, at Nackenheim on the Main, never allows his grapes to be gathered so long as they are wet by the rain or dew, believing that ripe grapes already contain all the requisites, including water, in their due proportions. He also allows the grapes to remain on the bush as long as possible; but has the perfectly ripe ones gathered as often as necessary, thereby avoiding loss by rottenness. He permits no eating of grapes, either in the press-house or in the vineyard, under penalty of instant dismissal and loss of the whole wages; to compensate for this, he pays twice as high, and pays even if the unfavorable state of the weather should allow but a few hours of labor.

By these simple means Mr. Ackermann produced, in the vintage of 1828, one cask of wine which formed the nucleus of admiration of the whole district, and realized a price of 2000 florins. At the same time, his neighbors could not sell theirs higher than 250 florins. Besides this, he produced two and a half more casks which did not fetch more than 550 florins, the wine being made of less ripe grapes. On the whole, he received for his three and a half casks 2550 florins, while his neighbors, for their three and a half casks of best quality of wine, only cleared 875 florins. By his superior intelligence, whereby Mr. Ackermann understood how to aid Nature, he netted a sum three times higher than the others, and gained over them 1675 florins. Nay, even more; for the actual cost of production to Mr. Ackermann's neighbors amounted to about 500 florins; therefore their three and a half casks left them a net balance of 375 florins, while Mr. Ackermann, even allowing his expenses to be 50 florins higher than theirs, had a surplus of 2000 florins—five times more than the others. And if we take, as with his neighbors, only 375 florins as net expenses of his vineyard, the rest of the four and a half times as large amount of 1625 florins was the well-merited fruit of his higher intelligence.

Results of Mr. J. Hörter.

This gentleman, the author of "*The Rhenish Grape Culture*," gained by the same proceeding, in the year 1825, from his vineyards at Damscheidt and Perscheid, two fuder of bouquet wine, for which he received 1240 *thalers*, and four fuder of good table wine, which sold for 800 thalers—2040 thalers in all; while his neighbors could not sell their wines higher than at 230 thalers per fuder; therefore for six fuder they received 1380 thalers. His higher intelligence netted, therefore, to Mr. Hörter, 660 thalers more than his neighbors received from their vineyards, including their labor.

Results of Messrs. Buhl, Jordan, and Wolff.

To further show the incalculable results of a careful picking, let us look at the following:

At their vintage of 1852, Messrs. Buhl produced a wine for which, in the same year, 5000 florins per cask were offered. They sold *one quarter cask* of Deidesheimer (*Prima Auslese*) for 1500 florins; the whole cask, therefore, was worth 6000 florins. Mr. Wolff, at Wachenheim, sold one cask of Wachenheimer of 1852 for 2500 florins, and asks for one cask of "1852 *Prima Auslese*" 8000 florins.

Method used in Tokay and in Syrmia, Hungary.

The foundation of the so-called "Tokay" Hungarian wines is the dry berries (*Trockenbeeren*), which, hanging on the bush, have almost been turned into raisins. The finest and most reliable season of the year in that country is the latter part of summer and the fall. The grapes ripen by the end of September, but, in order to obtain good "*Ausbruch*," they must become over-ripe. The vintage is therefore retarded till November, and frequently to the first frost; so that, by the progressive drying up of the sap in the stalk, the most matured berries shrivel together into raisins, losing their transparency, and turning into a kind of blue color.

As soon as these begin to show themselves the vineyards are opened, and from day to day, at first, only the best of the dry berries are gathered. The main vintage, however, is retarded as long as possible. When this takes place, the men and women form into a line, advancing uniformly, each person carrying, besides a wooden basket to hold the gathered grapes, another one about the waist, into which they throw the single berries which they break from out of the clusters. An inspector, whose chief duty it is to watch that none are eaten, orders from time to time another man to carry these picked dry berries to a vessel placed for the purpose, and keeps, in general, an eye upon all hands that they do not lag in their work, and are careful in picking. To prevent any possible negligence or oversight in this, even the green

grapes are subjected to an overhauling before they are transported to the press-houses. This is done upon tables placed near by, on which children spread the grapes, and pick out all the dry berries, and throw away the rotten ones.

The care taken throughout the whole proceeding insures a noble and superior article of wine, which, however, sells at a remarkably low figure. The antal, =44 Wiener maas, or $55\frac{3}{4}$ Prussian quarts, fetches scarcely 30 ducats; therefore, the highest price paid for one fuder of this wine would not be more than 2460 florins (=1500 Prussian thalers; 1 fuder=872 quarts, bringing 470 ducats per fuder); while the wines produced in the Palatinate and the Rheingau, by a similar careful arrangement, sell readily at from 3000 to 12,000 florins.

Relative Value of perfectly Ripe Grapes.

The well-known vinologist, Hörter, tells us, as a result of numerous direct observations, that during the vintage-time, on an average, the twentieth grape is eaten. These would give us 5 per cent. of the whole amount. Little enough it would seem, and yet a great loss and waste.

This 5 per cent. would form, in good years perhaps 10, in bad years perhaps 50 per cent. of all the ripe grapes; and, for the most part, the very finest berries are chosen for the mouth, and thus lost to the production of the most noble of all beverages. Considering what an amount of money-value the article bears, it is really to be looked upon as so much gold which is lost to the community of the district. The greatest possible care ought, therefore, to be taken to prevent the waste.

Benefits derived from Selecting.

Mr. B. Kölges proves to us that, from year to year, the method of picking out the berries finds more favor with the wine-makers, inasmuch as sufficient trials have undeniably shown that, if from three casks made of grapes that grew on the same piece of ground, two are from picked berries, these two will eventually fetch more than if all three casks had come from mixed-up grapes.

Benefits from a perfect Maturity of the Grapes.

The Count de Odart, a rich vineyard proprietor, near the city of Tours, in France, says, in his "*Observations sur le Moment des Vendages*," that, since the year 1833, he has not only confined himself to the careful picking of the berries, but he exposes afterward these selected ones to the air, spread out on hurdles. The sugar getting more concentrated by this process, he makes a wine that sells at three and four francs per bottle. The same quality he sold before at three and four sous.

We have now seen that, at this day, it has become an acknowledged fact that it is possible to produce from inferior vintages, by

a well-regulated management of the separated half-ripe and unripe grapes, a wine of better quality than results in medium years from the total mass of the grapes.

The chief object should be to produce, 1. Even from the very best vintages, still finer natural wines than before; 2. Even in the most unfavorable years, good wines, approaching in value these superior ones.

The very simple means to attain this are the following—provided, of course, the weather, as it is and is like to be, will permit their use:

1. To leave the grapes as long as possible on the bush.
2. To abolish the wasteful eating of grapes on the part of the gatherers by compensation in pay.
3. To pick frequently, in order not to lose the ripe grapes by rottenness.
4. To do at least one primary picking.
5. To select during the main vintage, (*a*), the most matured grapes; and, (*b*), from these those kinds mostly fit to make "bouquet wines," such as Riesling, Traminer, Muscat.
6. To press, and treat all of them separately.

IV.

PROGRESS OF WINE-MAKING UP TO THE MIDDLE OF THIS CENTURY.

We began our well-meant hints as to the means of gaining a lasting remunerative produce from our grape culture by showing that we may annually realize superior natural wines of the greater market value however little of material, *i. e.*, *perfectly matured* grapes, Nature condescends to give. This it does annually with more or less bounty; all the rest of the work belongs to man. But also to produce each year, at least partially, *superior* wines, we are solely enabled by not deteriorating what Nature has made good, in mixing it up with inferior stuff, *i. e.*, with grapes that are not able to make good wine. As even the most unfavorable seasons produce ripe grapes, so likewise grapes are to be met with in a very unadvanced state of maturity even in the most favorable ones, and this in a larger quantity than may generally be thought.

To press ripe and unripe grapes mixed up together would, however, turn out a mistaken policy. Grape-growers of a thoughtful mind have therefore, always since an accident taught them the first rudiments of the art of wine-making, exerted themselves to find means to obtain a palatable wine, even if the "must" should have turned out of inferior quality from Nature's workshop.

Thus, in remote antiquity, Aristæus taught the method of ameliorating the must by an addition of honey. Others tried this by adding different substances, salt, sea-water, ashes, chalk, gypsum, raisins, and, later yet, of potassa, brandy, and water. Some of these are still in use in our own days, especially the most natural and useful of them—water and sugar. And these have gained favor at this time in France, after such men as the honorable minister and eminent chemist, Count de Chaptal, and the eminent naturalist, Cadet de Vaux, and others, began to teach and warmly to recommend those means to improve greatly even the most inferior quality of must.

Up to their time it was the general policy of the wine-dealers acquainted with these "*arts*" to keep them jealously concealed from the great mass of the small producers, only transferring them as a sort of valuable family secret to their own kindred, in order not to be interfered with in their immense gains. The promulgation of the knowledge by the above-named savans checked this system effectually, not, however, without first doing battle to the combined fraternity of those privileged few, who ridiculed it, and gave out to the world that it was all nonsense, and that *Nature* alone could and would produce the true generous beverage.

We propose to give here some extracts from the principal works of some of these eminent men upon this subject.

Frenchmen.

MAUPIN.—This estimable chemist, in 1768, in his essay, *The Art of Increasing Wines by Water*, recommended to reduce by the addition of water the musts of the South, which contained too much sugar; by which process he said that he had always obtained, not only a greater quantity of wine, but also that which was richer in "spirit." He failed, however, to give instruction as to the proper regulation of the quantity of water, or to extend it to the treatment of sour musts.

LENOIR (*Traité de la Culture de la Vigne et de la Vinification*, 1828) says: I believe it was Mr. Delaveau that had the courage, notwithstanding the derision heaped upon him by the blockheads, to recommend the method of adding water to the overcharged must to make it more ready to ferment and produce more alcohol in the wine. He also, to the same end, recommended to add wine or beer yeast to such must.

Add so much water as will be found necessary to reduce the must to a density of ten degrees by Beaume's scale. In cold weather the water has to be sufficiently warmed, in order to impart to the must the most favorable temperature for fermentation. It has, indeed, even answered to mix *equal parts* of water with must very rich in sugar, and the wine produced thereby proved superior to that made of like must not watered at all.

The reason for not speaking of reducing the overcharge of acid

may be found in the circumstance that this happens very seldom in France, and, in case it does, in such small quantity that wine kept during two years will secrete all that is superfluous by its own action.

CHAPTAL (Count, Minister, and Peer of France), author of the celebrated essay, *The Art of Making Wine*, says:

In case the grapes have not attained their maturity, add to them the wanting ingredient. Mix sugar with them until the must has attained the sweetness of the perfectly ripe grape.

To give an example: Maguet added to must of picked unripe grapes, of the vintage of 1776, sugar, until it had the taste of a tolerably good and sweet must. In October, 1777, the wine made from it proved to be not only perfectly clear and fine, but also very sparkling, palatable, and fiery—in a word, just like a wine made of a good vintage, and raised on good soil.

Bouillon had about fifteen to twenty pounds of sugar per hogshead added to the must of his vineyard of Bellejames, and obtained a wine of excellent quality. This proves that by adding a proper quantity of sugar, a wine of required grade may be obtained, no matter of what quality the must may be; except that the must which contains too much sugar is to be reduced by water.

CLAUDE DUMONT says, in his essay *Moyen de doubler, de tripler même le Rapport de nos Vignobles*: France furnishes to her population hardly eighty litres of wine annually per head, and even this moderate quantity is not consumed. England, on the contrary, produces two hectolitres of beer to the head, and consumes it. This proves that England brews a very good article of beer, while France only makes very inferior wine. We possess, however, a very simple, yet very effective means to produce good wines even in the least favorable seasons, and to augment the quantity of good wines in better years. Here he goes on to say:

For instance: In order to produce one barrique (barrel) of wine of 32 veltes, it requires 800 pounds of grapes. These are put into a tub holding about 1000 litres after mashing them well. When the must attains a density of nine degrees of Beaume, add 500 pounds of water, in which previously 100 pounds of sugar and 10 pounds of cream of tartar have been dissolved. This has now to ferment, and the result may be vouched for.

Suppose the price of a barrique of wine be 100 francs, we shall now have two instead, in value 200 francs. The original cost of these may be put down as follows: One barrique of wine, 100 francs; 100 pounds of sugar, 60 francs; 10 pounds of cream of tartar, 2 francs; total cost, 162 francs: the net gain is, therefore, 38 francs. And besides this, these wines will be much more palatable and durable than by neglecting this advice.

By the calculation of these sugar prices, it appears that this treatise appeared in 1815 or 1816—(it bearing neither the name

of the place nor the year in which it was printed on its title-page) —at a time, therefore, when factories of grape-sugar were yet unknown in France, and *cassonade* (raw) sugar was mostly used for improving the must. The wholesale price of this, according to the then market value, was 60 francs. Now the expense for "grape-sugar" in Dumont's calculation would not amount to above 30 francs, thereby leaving a net gain of 68 francs.

PAYEN, Professor of Chemical Sciences at Paris, says: The main ingredient of the juice of the grape is the grape-sugar, whose quantity augments by the maturing process, while the quantity of acids decreases, though not in the same rate. The grape-juice, as a matter of course, is, in inferior seasons, poorer in sugar and richer in acids than in more favorable ones. By adding sugar, especially *sugar of starch*—that, however, has to be free from acids and pure —it is therefore possible to obtain a good wine from inferior vintages. This wine may not attain the standard of the best seasons' growth, but with proper management will turn out better than one without such a mixture.

In the *Revue des Deux-Mondes* of September 1st, 1856, the same savan expressed his firm conviction, in a treatise on the "Grape Sickness" and its influence on the French wine culture, that an addition of water to the must would be the sole means to prevent future want of wine.

Englishmen.

M'CULLOCH, in his work entitled *The British Wine-maker*, London, 1835, says: In France, for a number of years, trials have been made with grapes that had not yet matured (green) and sugar, and always with the best success. This induced me to try the same myself, with equal success, and repeatedly, under various modifications. The result, varying according to these, turned out a product in wines that were similar to the Champagne, the Graves, the Rhine and Moselle wines, of such an excellent quality, also, that connoisseurs even could not tell their difference from the above-mentioned originals. The grapes may be used for wine-making, no matter how unripe they are. The procedure satisfies perfectly, let them be even not more than half ripe or totally hard. The greenest grapes will give a wine of the quality of the White Hermitage when adding three pounds of sugar to the gallon, and, considering the value of the product, the costs are but small indeed. The rich and particular "bouquet" (flavor) of the original wines characterizes just as strongly these imitations.

In relation to the degree of maturity of the berries, the proportion of those ingredients which serve for the formation of wine must greatly differ. A large part of their salt, sour, and gum contents changing into sugar during the process of maturing, it is evident that, measure for measure, more of these parts are contained by the *unripe* than by the *ripe* berries.

To produce, therefore, a must of a quality resembling that of *ripe* grapes, water has to be added to the must of unripe ones, to reduce it and the proportions of those salt parts that would otherwise leave to the wine a disagreeable astringency. In order to obtain a wine similar to the Champagne or White Bordeaux, I would advise to mix the juice of half-ripe grapes with equal parts of *water*. If they are more advanced, the quantity of grapes has to be increased; if less, reduced.

ROBERTS says: I am in the habit of taking, in a good season, fifteen pounds of grapes to one gallon of water (therefore—one gallon of water weighing about nine pounds, and fifteen pounds of berries giving twelve pounds of juice—three parts of water to four parts of juice). I pick the berries from the pedicles and mash them, then mix them well with the water. After this, taking a sample, I filter it through a piece of linen, and test it by the must-scale, and cover up the tub. Next morning the fluid has to be well stirred, and a second sample to be tested and weighed. The must will now be found heavier (denser). These examinations have to be continued every morning and evening until the density no longer increases. Now the must has to be drawn off from the husks (remains of grapes); these are to be pressed, and a little water added, to extract from them every remaining particle of substance useful for the wine-making; then re-pressed once more, and this juice added to the must. The must has now to be weighed by the must-scale to find out the required amount of sugar. The greater the specific gravity, and therefore of the natural sugar of the must, the less sugar need be added. A proportion of two pounds of sugar, for instance, to one gallon of the mixture, will produce but a light wine. Three pounds to one gallon gives, however, a wine equal in strength to the best qualities of Champagne.

Germans.

BARON L. VON BABO (*Die Erzeugung und Behandlung der Traubenweines nach neueren Erfahrungen*, Frankfurt, 1848) says: There are three ingredients of the wine, by whose increase or decrease a natural improvement of the wine may be attained in the must itself.

1. The Sugar.
2. The Acids.
3. The Alcohol.

A genuine improvement of the wine is not to be called an adulteration of it, so long as it remains confined to those ingredients which are homogeneous to the constituent parts of the grape, and the production of which in them in larger quantity only depends on the accidental state of temperature. But as in the wine a certain relation of sugar, alcohol, and its other ingredients must of necessity prevail, so is it the duty of the wine-maker to regu-

late the addition of sugar as far as possible according to the quantity of other parts.

It is, indeed, very much to be regretted that as yet we know but little of this. Each season changes here the proportion. Wise would it therefore be to consider the weight of must in good seasons, and to regulate the adding of sugar by the must-scale.

Various observations show to us that the standard of acids of the wine frequently affects its price more than that of the sugar and alcohol. In a *southern* climate, where the larger amount of sugar covers more the small quantity of vegetable acids, a misproportion of these ingredients is rarely thought of. In northern climates, however, the acids frequently prevail, for the simple reason that the cool and damp weather of the summer, with but little heat from the sun, retards the sugar formation. In very unfavorable seasons, therefore, the inferior wine is, apart from the main ingredient the water, chiefly composed of acids; and these predominate in such a degree over sugar and alcohol that, after extracting the acids from the wine, almost nothing remains. By such action on these wines, nothing, therefore, is to be gained. Different would it be if, in a must with predominating acids, sufficient sugar be contained (no matter whether formed by vegetation or artificially added). Here a reduction of acids always operates to benefit. This may be done,

1. By deadening with chalk, or,

2. By properly unsliming (purifying) the must at the right time, this slime containing, as it seems, mainly those unperfected acids that rise in connection with the slimy particles. At least, observations have proven that, by acting thus, such a reduction of acids takes place that the skimmed wine thereby improved considerably.

The quantity of the acids to be reduced can not be exactly given, as it has always to remain in proportion to the other wine ingredients.

At an exhibition held in 1849 by the "*Badensche Landwirthschaftliche Verein*" (Association for Agricultural Purposes), a wine improved by this method by Mr. Von Babo was acknowledged to be the finest of the white wines of the season; and says this gentleman about his proceeding:

I added so much sugar to the must (before the fermentation) until the scale of Oechsle showed 98 to 100 degrees. The sugar used was pure white loaf. That such a procedure does not impair the durability of a wine, I might prove by a sample of superior wine of the vintage of 1847, which stood the test perfectly up to the present time (1860).

I had also to defend myself against many charges of having given too much publicity of the secret to the uninitiated, which might lead to misuse. The addition of sugar, known as "*Chap-*

tal's method," is well understood, and, true enough, frequently applied in a very improper manner. I, however, believe it to be good policy, in order to break down the misuses, to search into and publish the results as much as possible.

In a good season, and by the sun-heat of a warm summer, all the different elements of a grape necessary to form the taste of the juice attain, as a rule, their perfection as well as the sugar, dependent on site and soil of the vineyard. But if, in inferior seasons, the perfection of the sugar in the grapes does not take place, so it is with the other parts, and the acids originally contained in the grapes remain predominant. Of those ingredients, we only know the grape-sugar as sweetening and alcohol-forming stuff; concerning the rest we are still greatly in the dark. If we have no substitute for these, we know, at least, that the grape-sugar may be replaced by an exactly similar artificial article; and although we may not be able to give by it a wine of a certain known locality, with all its peculiar flavor, yet we may produce a sweeter and more palatable article.

Somewhat different it turns out in regard to red wines. These contain usually less taste-forming parts, and these, in good seasons, very like to those in inferior ones. But the sugar, and, therefore, alcohol contents, as well as the sweetness of the wine, are subject to remarkable changes. By adding the like quantity of sugar in inferior seasons as in good ones, the results will always be an agreeable red wine. I produced from a must of the vintage of 1849, from a medium locality, at a weight of 86 degrees of Oechsle's scale, by adding sugar up to 96 degrees, a very palatable wine not inferior to that of 1848.

I will, however, here say that this addition of sugar should only be carried up to the must standard of good seasons; more ought to be classed as adulteration.

Professor BALLING (*Die allgemeine Gährungs-Chemie, und die Bereitung des Weines*, Prag, 1845) says: In inferior seasons and localities we find usually the must with very little sugar contents; these, however, relatively larger of cream of tartar (*Weinstein*) and free acids.

Such a must can be improved by adding the sugar that is necessary for the production of a good wine. To do this, add to the weak must so much grape-sugar as will be found necessary to give it the desired concentration. By not using too much sugar, the must contains sufficient yeast (ferment) to effect the fermentation perfectly, and it will produce a more durable wine and richer in alcohol: 100 pounds of must of 14 per cent. by the saccharometer (or 57° of Oechsle) require 7½ lbs. of dry artificial grape-sugar (starch-sugar); this will give 107½ lbs. of must of 20 per cent. saccharometer (83° Oechsle). The contents of cream of tartar and free acids is in this way distributed in a larger quantity of fluids, and their relative proportion in consequence lesser, and the wine *richer*.

"It would be extremely desirable to abolish all the prejudices that still exist against this method."

Dr. DOEBEREINER, in his *Gaehrungs-Chemie*, Jena, 1822, says: I recommend the following *English* method: Take one gallon of water to each gallon of white grapes; crush them, and let them stand for one week without stirring; then draw off the juice. Add to each gallon 3 lbs. of loaf sugar; put the whole into a barrel, but take care not to close the bung until the mass has whizzed out. After six months' time the wine may be drawn off into bottles.

Again he repeats the same counsel in 1843, in his *Privilegirte Jenaische Wochenblätter*, 1843: Take to 1 eimer (64 Prussian quarts—about 17 gallons) of must of half-ripe grapes, 1 eimer (17 gallons) of good river or rain water, 20 lbs. of loaf-sugar, and half a quart of beer-yeast, and let the whole ferment in a moderate temperature. According to my strictest observations, 20 lbs. of sugar will give, during the process of fermentation, 10½ lbs. of alcohol (wine-spirit), and it will produce a wine at least equal to the French.

In his *Aeltere und Neuere Erfahrungen ueber die Fabrication und Verbesserung der natürlichen und künstlichen Weine*, Jena, 1850, he counsels: In case the must contains a great quantity of free acids (acids of apples and wine), it will be prudent to mix it, before the fermentation sets in, with about one per cent. of its weight of slightly burned and finely-pulverized chalk, and increase its sugar stuff by an addition of grape-sugar. The juice of unripe grapes produces only, by reducing its acids in the prescribed manner, a drinkable wine, then by adding sugared water (in equal parts according to the weight), and fermenting it by a very little beer-yeast. It will do to take to 17 gallons of such must 17 gallons of water, 30 to 40 lbs. of grape-sugar, and 1 lb. of beer-yeast (bung-yeast). There may also be added to the whole mass 1 or 2 lbs. of crushed grape-seeds.

G. C. BARTELS (*Kurze Anweisung zur rechten Behandlung deutscher Weine*, Düsselthal, 1843) expresses himself as follows: Every wine is partially produced by Nature and partly by Art. It is the produce of a chemical process, by fermenting juices, guided by man to a certain point, where he has to interrupt it in order to make it *wine*, and not let it turn into *vinegar* by allowing it to continue its natural course.

Pure wines are such as are produced by a well-regulated fermenting process. *Improved* wines differ from *natural* ones by the latter being produced without man's help, while the former became, by a regulated treatment, what Nature ought to have made them.

I proceed now to show in what manner to produce a palatable and healthy wine even out of inferior must, or that of positive bad quality. The principal condition is *reducing the acids in the*

must of sour grapes. To do this effectually we have a very simple and cheap means—pulverized chalk. A too watery must requires an addition of sugar, otherwise the wine will turn out weak and not durable. Good care ought, however, to be taken not to use too much sugar. The best plan is to take so much as would be required to obtain the strength of a medium season.

Dr. F. HUBECK, Professor of Agricultural Sciences, says (in his *Essay on the Grape Culture in Lower Styria*): We have three ways to improve the sugar-contents of grapes, viz.:

1. By keeping them on layers to mature.
2. By boiling the must.
3. By a direct addition of sugar.

We have three kinds of sugar: cane or beet sugar, grape or potato sugar, and "slime sugar" (*saccharum mucosum*). Considering that, according to the results of the French, who have attained such a high degree of perfection in the art of wine-making, the potato-sugar is the most adapted to this purpose, we have the conviction that the potatoes are one of the chiefest means to improve and procure an extended market for the wines of a country.

J. C. LEUCHS (*Vollstaendige Weinkunde*, 1847) says: For improving the too watery must we have three excellent methods, viz.:

1. The boiling of the must.
2. The addition of must boiled down to the consistency of molasses.
3. The addition of sugar-sirup (which is, in effect, sugar and water—for sugar-sirup is but sugar dissolved in water), starch or grape sugar, cane-sugar, or honey.

To must that, besides water, contains much acids, an addition of these bodies (sugar or honey) is preferable to boiled must. Especially recommendable are the grape-sugar and cane-sugar.

Improving the too *acid* and *sour must:* These parts may be essentially reduced by increasing the *sweet ones;* therefore by adding boiled must or sugar. Unripe grapes may be allowed to ferment with their skins and pedicles. Care must be taken not to crush the seeds. The addition of sugar and water differs according to the acid and astringency of the grapes.

Dr. C. R. FRESENIUS (*Chemie für Landwirthe*, Wiesbaden, 1849) says: *Addition of sugar to Must.*—The wine-producers increase the specific gravity of their must, in seasons whose unfavorable temperature did not allow a perfect formation of the sugar stuff in the grapes, by an addition of sugar up to the standard of good seasons, and obtain thereby a wine richer in spirit and more palatable than from like must without this addition.

Professor J. VON LIEBIG (*Annalen der Chemie und Pharmacie*) says: Young wines contain, among other parts, sugar that, by keeping, gradually disappears, and some yet very little known gum-like stuffs, that, in boiling the wine, very easily get a brown-

ish color. The existence of these is apparently principally effected by the quality of the soil and the locality of the vineyard in which the grapes grow; and it is self-evident that the sugar can not replace the qualities that are dependent on those other parts. For instance, it will be possible to produce at Dürkheim, in medium or inferior seasons, a wine much better in quality by an addition of sugar, and yet it will always be but a *better Dürkheim* at Worms a *better Liebfrauenmilch*, in Weinheim a *better Hubberger*, but never a *Steinberger*, a *Rüdesheimer*, or any other different species of wine.

Fully conscious of the contradiction of many wine-producers, yet I have the full belief that, twenty-five years hence, during *inferior seasons*, this method of improving the must will be generally adopted.

Dr. Ritter (*Weinlehre*, Mayence, 1817) says: The main want of the German must, in medium and inferior seasons, lies in the deficiency of sugar stuff, and an overcharge of free acids. A ridiculous prejudice took this deficiency to be an essential quality of the Rhenish wines, which, however, is contradicted by the but seldom happening seasons in which the grapes attain their full maturity. Connected with this overcharge of acids is generally the want of sugar, for which reason the wine contains but little spirit.

It would therefore be a great advantage to introduce into Germany a method to remedy both evils. This method (in France in use even with greatly richer must) would be, boiling the must in a kettle up to 70° Reaumur, and then reducing its acids by a mixture of chalk. Must very poor in sugar has to be improved by the addition of sugar.

An opinion expressed by a medical commission, installed by order of the royal Prussian government at Coblentz in the year 1844, in a controversy about the practicability of "Chaptal's method," runs in the following words: The proper chemical analysis was neither directed upon the contents of sugar nor that of spirit (alcohol), inasmuch as neither one, when added before the fermentation takes place, is discoverable by chemical means from that sugar or alcohol which is contained in the grapes, and which develops itself only by a fermentation. The cane-sugar added changes, during the fermentation, into grape-sugar, and leaves no difference whatever. The spirit of wine or alcohol is, however, contained in every species of wine, and by its nature not distinguishable, whether formed by natural grape-sugar, or cane-sugar changed into it.

By this published opinion, the method of improving wines by sugar or spirit addition was therefore officially acknowledged and recommended.

V.

THE PRINCIPAL CONTENTS OF THE GRAPE NECESSARY FOR THE FABRICATION OF WINE.

In the foregoing chapters we have chiefly spoken of the sugar, acids, and water as parts of the grape-juice. Properly speaking, these form the main ingredients from which the wine results, and that produce a wine of as good quality as any given species of grape is able to furnish from the particular site of the vineyard in which it grew, provided those main constituent parts were contained in a right proportion, or their relation to one another were rectified in the must before the fermentation took place. But it now becomes necessary to look closer into those principal agents of wine-producing, as water, sugar, and acids, as also a few others, that merit consideration solely because of their *not* belonging to the wine, in order to manage properly those grapes that are not fit for producing a wine of superior quality, or to know the most profitable way of turning the residue of the grapes to the best possible profit.

The Water.

The water which is contained in the must is essentially the same as that falling from the clouds. It contains the grape-sugar and the other parts of the must in solution, just as sugar-water contains the sugar dissolved therein. By distilling a quantity of must we get, however, perfectly pure water without any taste.

We have soft and hard water according to its being impregnated by minerals sucked up by running through them. Green vegetables will not get soft when boiled in hard water; and, to reduce the must, none but soft water should be used. The hard water may be charged with gypsum or lime, according to the kind of rock through which it runs, and differs from soft water by getting cloudy when a few drops of soap-spirit (soap dissolved in alcohol) are poured into a tumblerful of it, while soft water retains its clearness. To know whether it is charged with lime or gypsum, it must be boiled and left to cool: if with gypsum, it remains cloudy; if with lime, it will turn clear again. By boiling limy water, therefore, and leaving it to settle, it may, by this process, be turned soft, drawing it off from the bottom residue. The objections to using hard water to improve wines are the following:

1. If it contains *lime particles*, (*a*) the lime combines with a part of the wine acid of the must, forming cream of tartar, settles down as such, and is therefore lost for the formation of wine, and this may retain less acid than desirable; or, (*b*) bottles cleaned out with water highly charged with lime parts, and filled in a yet wet state with wine will instantly get covered by a thin coating of

wine-acid lime, forming itself to a residue in case they remain standing upright, or are laid down after being corked up.

2. If it contains *gypsum particles*, it will, being used to the must, impart to the produced wine a disagreeable taste.

It hardly needs mention that neither water from still-standing ponds nor from foul wells should be used. In a very wet fall, the quantity of dew or rain-water entering the must depends greatly on the form of the grapes. We shall look a little closer into the quantity and the effect of this water. For instance: a grape, if plucked on a warm day, and accurately weighed after this, then put into a vessel filled with water for a few minutes and weighed over again, will show a gain of 8 to 12 per cent. water, according to the distance of the berries from one another. If, therefore, the vintage takes place after a rain or a heavy dew, from 8 to 12 per cent. of water is transferred to the tubs by the grapes themselves: 100 pounds of grapes, on an average, however, giving not more than 70 pounds of wine, it is evident that, as all the added water remains in the must, this 8 or 12 per cent. of the weight of the grapes forms from 11½ to 18 per cent. of the weight of the wine. In case such a must, as is usual in rainy seasons, holds besides a sugar content of 16 per cent., this will be reduced in the first case to 13, in the latter to 12 per cent., and produce in both but an inferior quality of wine; while, if the clouds have opened upon the fall, it will be but necessary to add but 3 or 4 per cent. of grape-sugar to produce not only a wine equally as good as without rain, but really a much better article, because more palatable and mild, and, besides, from 11 to 17 per cent. more in quantity. Greatly increased will this quantity of water be if the gathering takes place on a rainy day, because then the rain falls also into the open receiving-tubs.

Knowing by experience that the perfectly-matured grapes possess all the ingredients necessary for the production of the most superior wines, in proportions that suffer no change whatever, and learning by the exterior form of the grape that to attain this required end the most matured ones must only be gathered during sunny, warm days, a gathering, during a rain, of only half-ripe grapes will therefore, in one point, only tend to profit by the misproportion of the too much prevailing acid to the water and sugar being at least improved, however not regulated—a misproportion vastly more annoying than that of a low content of sugar.

We might therefrom long ago have drawn the lesson to add ourselves the wanting water to the acid must whenever the clouds fail to send it.

Sugar contained in the Grape, and the Must-Scale.

The sugar contained in the grapes in a dissolved state appears in the raisins in the shape of white grains, essentially being the same kind as that crystallizing in the honey when it dries up.

From the common cane or beet sugar it only differs by being found, when in a natural dry state, in irregular shape. Many other plants contain the same kind, as apples, pears, figs, wherefore it is frequently called "*fruit-sugar*." Its *taste* is less sweet than that of common sugar, insomuch that two and a half ounces of the first will only give the same degree of sweetness as one ounce of the latter. In water it dissolves less freely, one ounce of water being only able to receive two thirds of an ounce of it, while it readily will receive three ounces of cane-sugar. In boiling water, however, no difference is perceptible.

The spirit (fire) of the wine is due to the sugar parts of the must forming alcohol during the fermentation. Both kinds of sugar produce it nearly equally.

The richest contents of sugar observed in our climate (Germany) in the finest kinds of grapes, such as Riesling, Rulaender, Traminer, etc., amount, in the best localities and the warmest seasons, to 28 or 30 per cent., while in southern climates not seldom to 50 per cent. Dr. Walz observed, during the month of August, 1846, a daily increase of 0.4 per cent. of sugar in the juice of Traminer grapes.

The science of chemistry has given us various instruments and means to measure very accurately the sugar parts contained in the grape-juice. Of these, Oechsle's Must-Scale is considered the best.

Oechsle's Must-Scale.

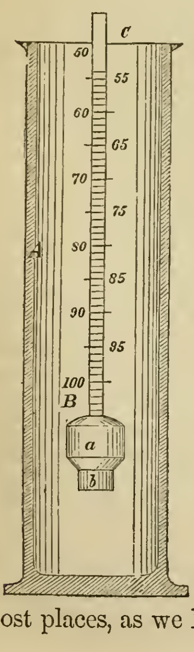


Fig. 1.

A (*Fig.* 1) is a glass tube, or, instead of this, a common tumbler, filled nearly to the brim with must, into which the scale B is inserted. The scale consists of the float *a*, the gravity point *b*, and the stem *c*. The stem is divided by lines into degrees from 50 to 100, as shown in the cut. Before inserting the instrument into the must (which is to be filtered through a piece of linen), draw the "scale" through the mouth to wet it a little. After allowing it then sufficient time to get steady, find out down to which line it has been sinking, press it down a little more, and, after then steadying itself again, it will show the *specific gravity* of the sugar parts marked by degrees.

The following table, compiled by actual minute observations, will be a tolerably reliable guide, although it may not prove equally correct for the must of all the different kinds of grapes of different parts of the world, their contents of extract too widely varying. It will, however, be found quite sufficient for most places, as we know at our day that the general value of the

wines depends more on a certain part of alcohol (therefore *sugar* of the *must*) than on a medium part of acids.

NEW TABLE FOR THE USE OF OECHSLE'S MUST-SCALE.

Degrees of the Must at 14° Reaumur.	100 Pounds of such Must contain Sugar,	100 Litres of such Must weigh,	Degrees of the Must at 14° Reaumur.	100 Pounds of such Must contain Sugar,	100 Litres of such Must weigh,	Degrees of the Must at 14° Reaumur.	100 Pounds of such Must contain Sugar,	100 Litres of such Must weigh,
	Pounds.	Pounds.		Pounds.	Pounds.		Pounds.	Pounds.
41	8.0	206	64	14.0	210	87	20.2	
42	8.3	"	65	14.2	"	88	20.4	215
43	8.6	"	66	14.4	"	89	20.7	"
44	8.9	"	67	14.7	211	90	20.9	"
45	9.2	"	68	15.0	"	91	21.2	"
46	9.4	"	69	15.2	"	92	21.4	"
47	9.7	207	70	15.5	"	93	21.7	216
48	9.9	"	71	15.8	"	94	21.9	"
49	10.2	"	72	16.1	212	95	22.2	"
50	10.5	"	73	16.3	"	96	22.5	"
51	10.8	208	74	16.6	"	97	22.7	"
52	11.1	"	75	16.9	"	98	23.0	217
53	11.4	"	76	17.2	"	99	23.2	"
54	11.7	"	77	17.5	213	100	23.4	"
55	11.9	"	78	17.8	"	101	23.7	"
56	12.2	"	79	18.0	"	102	23.9	"
57	12.5	209	80	18.3	"	103	24.2	218
58	12.7	"	81	18.5	"	104	24.5	"
59	13.0	"	82	18.8	214	105	24.8	"
60	13.2	"	83	19.1	"	106	25.0	"
61	13.4	"	84	19.4	"	107	25.2	"
62	13.6	210	85	19.7	"	108	25.4	219
63	13.9	"	86	20.0	"	109	25.7	"

In order to avoid possible variations, it will be well to bring the must up to a temperature of 14° Reaumur by putting the vessel containing the must for a few minutes into warm water.

Artificial Grape-sugar.

A good must of 20 per cent. weight of sugar parts contains, on an average, 76 per cent. of water, and leaves, after this has evaporated, about 24 per cent. as an extract, holding all the not volatible ingredients of the grape-juice. The sugar, however, as long as it is dissolved in water, holds the same relation as reducing medium of the acids in regard to the room which it occupies in the fluid as the water itself, united to which it forms the sugar-water. This proves that a good grape must, in the proper proportion to the acid, not only contains 76 per cent. of water and 20 per cent. sugar, but 96 per cent. sugar-water; these, however, will be found, according to the more or less fiery wine (strength of alcohol), composed of more sugar and less water in the first case, and in the latter of more water and less sugar.

Grape-sugar is made by artificial means of the starch of potatoes, therefore frequently called *starch* or *potato sugar*. It received the name of grape-sugar because of its not only being similar to

the article produced by the grape, but in all respects alike. It is, therefore, the better adapted to improve the must, as its price always, even at very high market value of the potatoes, ranges from 25 to 30 per cent. lower than common cane or beet sugar. The artificial, as well as the natural grape-sugar, is, in its dry state, a combination of six atoms of oxygen, six atoms of carbon, and five of hydrogen; while the common cane-sugar contains, in its dry state, five atoms of oxygen, six of carbon, and five of hydrogen.

As an article of merchandise, we find the artificial grape-sugar in the following forms:

1. Thick liquid, or "sirup," of various sugar contents, and therefore more or less thick and transparent; white or clear as water, light yellow to brown.

2. Consistent, but, when fresh, more or less wet, about like very dry soap, from milk-white to light yellow, put up in barrels or boxes, in form of lumps.

3. In the shape of sugar-loaves, very hard, and from white to yellowish color.

4. Dry, (*a*) finely pulverized and snow-white, as flour-sugar, (*b*) crumby, milk white.

5. Crystallized sugar, an invention of the eminent chemist Mr. Anton, of Prague. In this form it is principally used for the fabrication of Champagne wines.

The relative value of the different kinds of sugar depends naturally on their real sugar parts. In 100 pounds of water-free sugar are contained of these:

Of cane or beet sugar	90–93 lbs.
" dry grape-sugar	89–90 "
" consistent grape-sugar	80–84 "
" wet (fresh) "	75–80 "

Considering the *sirup*, this may be easily and accurately determined by the saccharometer of Balling. The saccharometer is a balance-scale (similar to the must-scale) that indicates by its more or less deep sinking into solutions of pure sugar how many parts of sugar such a solution contains. For instance, if it sinks in a sirup warmed to 14° Reaumur down to the degree-line of 75, it contains in 100 pounds 75 pounds of pure sugar.

In order to examine in this manner *hard* grape-sugar, it is necessary to dissolve 10 ounces of it in 90 ounces of hot water, to weigh the same over again, and add so many ounces of water as are wanting to make up the 100 ounces; and now the saccharometer has to be sunk into the solution. Had 10 ounces of perfectly dry sugar been dissolved in 90 ounces of distilled water, the instrument would sink down to the tenth degree-mark; *i. e.*, it would mark 10 degrees of sugar parts. If it shows, however, but 8 degrees, it becomes evident that the 10 ounces of hard but *still wet* sugar held only 8 ($8\frac{2}{10}$) ounces of *dry*, or the examined grape-sugar was composed of 82 per cent. sugar and 18 per cent. water.

Sirups of a darker color than light yellow can only be used in the fabrication of red wines.

The Acids of the Must.

Those contained in the grape-juice are part *free*, part combined with earths and alkalies, with which they form bitter as well as neutral salts. Only the *free* and the *bitter* salts can be detected by the taste, and proved in their total quantity in the wine.

The acid parts, besides deciding the palatable taste of the wine present in proper proportions, also determine and influence, according to general belief, the existence of many different combinations, and by these the formation of the *aroma* (flavor).

To prove this supposition, it is said by many that principally those wines that contain a great deal of acids develop a rich *bouquet*, while this is almost entirely wanting in the southern wines holding less acids. It seems, however, that in asserting this, the bouquet is confounded with the *wine-smell* appertaining to *all* the wines of a larger acid content than the southern have. In this connection, also, that part of acids can only be considered as conditioning the development of the wine-smell that is proper to those wines in the *best* season, because otherwise the over-acid wines of inferior seasons would have to show the strongest wine-smell.

Hence follow the consequences of this in favor of a reduction of the contents of acids of a more than ordinary sour must upon them in *good* seasons, the more properly, as we know that for a long time various articles, as chalk, lime, potassa, etc., have been used to reduce those acids. However, the real relation of these *free acids* remained a secret until that eminent chemist, Dr. LÜDERSDORF, supplied this want, and gave thereby a firm and secure foundation to the art of wine fabrication. He recognized the fact that the most esteemed wines (in other respects of equally good qualities) were more valued by their quantity of *medium contents of acid* than that of *alcohol*. This induced him to examine in the year 1841 about eighteen different sorts of wines of the vintage of 1834, and to publish those results in *Erdmann's Journal for Chemistry*, which may be seen in the table on the next page.

It will not be amiss to add a few remarks here for such as have no farther knowledge of the science of chemistry.

Acids and alkalies are characterized by their capacity of neutralizing each other's qualities. For instance, acids change the *blue* color of litmus tincture into *red;* now to this red fluid add a sufficient quantity of an alkali, and the blue color will be restored, the acid being neutralized. The point at which this takes place is called the satiating point. The greater the quantity of acid (say vinegar or wine) which had been added to the litmus tincture in order to recover it, the more alkali will be required to change the color back to blue. Now, as a certain quantity of alkali is required to neutralize a definite amount of a particular

acid, the amount of acid can be ascertained by the quantity of alkali which was required to satiate it. This calculation will, however, be perfectly accurate only when the fluid—for instance, vinegar—contains only *one kind* of acid. It is different in regard to wine. This contains *different kinds* of acids, as wine-acid or cream of tartar, apple, grape, and acetic acids, and each of these requires a little different quantity of the same alkali for its satiation. It is therefore impossible to determine with perfect accuracy the quantity of the acids contained in a wine or must except by a very difficult analysis, which is at the same time qualitative and quantitative.

Number.	Names of the examined Wines.	Contents of Acids counted as Acetic Acid in 1000 Parts.	Contents of Alcohol in 100 Parts.	Contents of Extract in 100 Parts.	Price per Bottle in Berlin, in Silber groschen.	Reduced into Dollars and Cents.
1.	Haut-Sauterne	4.8	9.7	2.1	36	$0 81
2.	Haut-Bommes	4.8	9.5	1.7	25	57
3.	Medoc-Bourgeois	5.3	7.4	1.9	15	34
4.	Haut-Ceroes	6.8	8.5	2.0	17½	40
5.	Oppenheimer	4.4	9.8	1.7½	30	69
6.	Ungsteiner	4.5	6.7	1.9½	30	69
7.	Forster-Riesling	4.8	9.0	1.7	25	57
8.	Neuberger	4.9	6.7	1.9	25	57
9.	Viersteiner	5.2	8.8	1.9	25	57
10.	Brauneberger	5.2	7.8	1.5	20	46
11.	Markobrunner	5.3	7.8	2.1½	60	1 38
12.	Pisporter	5.5	6.7	1.7	15	34
13.	Leistenwein	5.7	7.2	1.9	30	69
14.	Zeltinger	5.7	7.3	1.7	12½	29
15.	Roedelser	6.1	8.5	1.9	15	35
16.	Grüneberger	7.8	6.5	2.1½	7½	18
17.	Naumburger	8.3	6.4	2.2½	7½	18
18.	Tokaier	5.5	12.1	10.62	45	1 04

In a purely scientific essay, like the one published by Dr. Lüdersdorf on his examinations, he could, therefore, not say, as it has been done in the foregoing table, that the examined wines held such a portion of their weight in acids, but only, using as means to neutralize a *solution of ammonia*, what *quantity* of this *proof fluid* was required to satiate the acids of each of the wines he examined. The uninitiated, however, not understanding these remarks, it was deemed better to substitute the numbers contained in the third column of the table, expressing the calculated acid content, as acetic acid, *i. e.*, the acid of vinegar. These remarks may not be scientifically accurate, but they are sufficiently accurate for practical use. The main point being this: that the same quantity of a neutralizing agent that satiates 11.4 pounds of acetic acid, will satiate 12.7 pounds of apple acid, or 14.25 pounds of wine acid; and so a quantity of sugar-water that will sweeten to a certain point of taste 14.25 pounds of wine acid, will bring to the same degree of sweetness only 12.7 pounds of apple acid, or 11.4 pounds of acetic acid. Instead, therefore, of expressing the

result of our examination of a must or wine by saying, "It contains so many thousandth parts of free acid," we should, in strict correctness, say, "It requires such a quantity of the proof-fluid to satiate its acids, according to Otto's Acid-Scale."

By comparing the foregoing table, we find that wine-consumers estimate as *good* wines only those whose contents of acids do not much exceed 6 parts in 1000.

Dr. Lüdersdorf's examinations would have been still more suggestive if extended upon a larger assortment of wines of a higher content of acids. This has been done for Styria by Dr. Hlubeck, who gives a table of twelve kinds of wines, of vintage 1841, examined by him. These examinations show evidently that the influence of the acids upon the price of such wines is so very unfavorable that, for instance, the one of No. 5 is not able to compensate for the contents of acid only 0.7 per cent. higher, although it is $1\frac{3}{6}$ per cent. higher in alcohol than No. 6.

Number.	Names of the Examined Wines.	Contents of Acids in 100 Parts.	Contents of Alcohol in 100 Parts.	Price per Eimer at 60 Quarts, in Silber groschen.	Reduced into Dollars and Cents.
1.	Brandner	5.0	9.8	240	$5 52
2.	Wiseller Drenowezer	5.0	9.5	202	4 65
3.	Murberger	5.9	8.3	202	4 65
4.	Radkersburger	6.2	8.4	192	4 42
5.	Johannisberger Pickerer	6.4	7.9	187	1 90
6.	Kerschbacher	7.1	9.5	168	3 86
7.	Sandberger	7.5	8.9	161	3 70
8.	Wiseller Johannisberger	8.3	8.9	144	3 31
9.	Pettaner Stadtberger	8.8	9.3	137	3 15
10.	Sauritscher	9.1	10.2	132	3 03
11.	Marburger Possrucker	11.6	6.7	103	2 36
12.	" Koschacker	12.0	6.7	98	2 25

As a proof that it is not the *quality* or *peculiarity* of some of the acids which constitutes their influence upon the quality of the wines, but principally the *proportion* of their entire quantity to the other main constituent parts, we have the experiments of Mr. Maguer, mentioned by Chaptal, who produced superior wine from *unripe* grapes.

For practical wine fabrication it suffices perfectly to know with certainty:

1. That by the maturing process of the grapes their sugar contents increase, while the acids decrease; that we therefore have it in our power to improve them *doubly* by leaving them as long as possible on the bush.

2. That all the wines, in order to be estimated as good and palatable, must contain *at least* $4\frac{1}{2}$ *pro mille* (thousandth parts) of free acids (counted as vinegar acid), and *not more* than $6\frac{1}{2}$.

3. That all must containing more than 6 thousandths of free acids must be considered as having *not enough water* in proportion to its acids.

4. That experience has taught us, for more than ten years, in all the different German grape districts, that a proportionable addition of water and sugar forms the means to produce, even from the most sour must, as drinkable and as good a wine as is otherwise produced in good medium seasons.

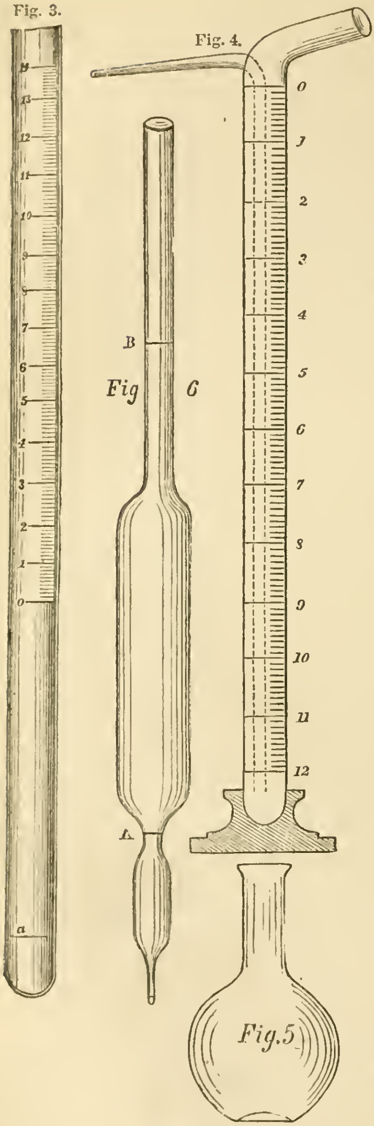
A remarkable attribute of the acid of wine lies in the fact that, reduced by a great deal of water and mixed with but little alcohol, it will, in the course of time, change into acetic acid, which explains the little durability of the weak wines of inferior seasons. Acetic acid *is not contained in grapes;* it is merely oxydized alcohol, and can only be formed after this is previously produced by fermentation.

Acid Scales and their Use.

Fig. 2.

The first instrument of this kind, invented by Mr. Otto, which, being based upon the principle that the contents of acids are estimated as those of vinegar, proved very useful, and was generally adopted. We have at this day, however, another newly-invented one, in *Otto's Acetic Acid Scale* (*Fig.* 2). This is composed of a glass tube, ten or twelve inches long and half an inch wide, closed at the bottom. This is filled with blue litmus tincture up to the line *a*. After this, the must, previously filtered, is added up to the line 0, taking care that it is not in a state of fermentation. By the action of the acids in the must, the litmus tincture, which would retain its *blue* color if mixed with water, turns *red* or *rose* color. Now if to this fluid a solution of ammonia be added, the tube being in the mean time shaken gently to promote the mixing, it will be found that the red color changes to an *onion-red* or *violet-blue*, according to the greater or less quantity of the neutralizing agent. This, as before stated, shows the perfect satiation of the acids, and the degree line of the fluid in the tube shows the contents of acids of the must by whole, half, and quarter per cents. of weight. The lines 1, 2, 3 mark the whole percentage, and the lesser divisions the quarter per cent.

This highly valuable instrument needed but a more commodious contrivance to adapt it better still to general use. This has been effected by giving to it (as shown in *Fig.* 3, on the following page) a little smaller diameter, but at the same time an exactly half as large again cubic space to all its divisions. By this it becomes possible to divide each per cent. into tenths instead of fourths; the whole space above 0, therefore, is divided into thousandths, and gives to each *pro mille* the same space—*i. e.*, the same space from one dividing line to another—as the former instrument offered for the quarter per cent. lines. The only evil was, that by the turning over and shaking of the glass tube to



Geisler's Acid-Scale.

promote the mixing, a little of the contents will adhere to the skin of the thumb that closes the orifice, which might easily amount to one half *pro mille.*

This fault is remedied by a new scale, invented by Mr. Geisler, the patentee of the *Vaporimeter*, used to determine the alcoholic contents of wine. *Figs.* 4, 5, and 6 represent Geisler's Scale. It is composed of three pieces, all of glass, put up in a box. The price is two and a half Prussian thalers. Besides these pieces, three small vials are required in the process of examination. One of these contains tincture of litmus, another a solution of sal ammoniac (1.369 per cent.), and the third holds some of the wine or must to be tested. The parts of the Acid-Scale are these: 1. *A Burette*, or Graduated Tube (*Fig.* 4), which rests upon a small wooden stand to hold it erect; 2. *A Flask* (*Fig.* 5); and, 3. *A Pipette*, or Suction Pipe (*Fig.* 6).

The manner of examination is as follows:

Bringing first the must to the normal temperature of 14° R., and the litmus tincture also to the same; put then of both, by means of the pipette, exactly the necessary quantity into the flask by alternately filling the pipette at first up to the division line A with the litmus tincture, and then, when this has run out into the flask, with must up to the line B. To fill the pipette, hold its orifice into the glass with the tincture or must, and suck, by applying the mouth to it, the fluid up to a little above the proper division line; then quickly close the upper orifice by the thumb, and allow, by alternately closing and opening the orifice, the tincture or must to enter the glass until the tincture stands exactly

on the line A, or the must on B. In the introduction of these fluids into the flask, the last drops must be ejected by blowing into the pipette. Then, with the right hand, place the thinner tube of the burette into the phial containing the solution of ammonia, and, applying the orifice of the wider tube to the mouth, fill it by sucking exactly up to the division line 0 of the scale; then take the flask between the thumb and second finger of the right hand, placing the smaller tube of the burette into the mouth of the flask, which is to be shaken continually; put the solution of ammonia, drop by drop, into the flask, from the burette, until the *red* color of the fluid begins to change to blue, or until it has assumed the deep *bluish-red* of the onion. This appearance shows that the acids have been satiated. This having been ascertained, hold the burette perpendicularly and see how much ammonia has been consumed, that is, to what division line of the scale the burette has been emptied. The acid contents of the examined must are in relation to the quantity of the proof fluid consumed in this manner, that the larger division lines which have the numbers 1, 2, 3, etc., indicate so many thousandth parts, and the smaller lines indicate ten thousandth parts.

Before getting used to the handling of this instrument, it will be well to make examination of the must by *litmus paper*. To do this, when the mixture in the bottle begins to turn blue, thrust the end of a small slip of blue litmus paper about half an inch deep into it, and let immediately after the inserted end glide between the thumb wetted with water and the second finger. So long as the acids are not perfectly satiated, the inserted end of the paper will appear more or less *reddish;* and the satiating point is not attained until the proof-paper remains *blue* immediately after the cleaning.

In examining *red* must, the proceeding is to be modified in the following manner: Instead of litmus tincture, fill the pipette with *water* up to the line A, and bring this into the flask. After adding the necessary quantity of must, pour dropwise, shaking it from the very outset, four *pro milles* of solution of ammonia into the mixture, and prove it, as well as after each successive necessary addition of ammonia, with litmus paper, until it no longer reddens when cleaned. A few trials will, however, suffice to make one quite proficient in the use of the instrument.

As it has, however, frequently happened that an addition of water has been made *ad libitum*, it may be well to give yet another manner by which one may tolerably well rely on the taste of the tongue. This needs nothing but two glass bottles, each one holding a little more than two and a half quarts, and marked A and B, in order not to confound them. Farthermore, a few tin measures, one of which must hold one quart, the other one half, and the third *exactly* one twentieth of a quart, each having a handle and a spout; also two small tin funnels, one for each

bottle. When the acids of a must are to be examined, one quart of must, previously filtered through linen, is to be measured off into each bottle (it would be well if the must was freshly pressed). After this, add cold water to it in both bottles, in small, *exactly equal* portions, until, shaking the mixture in the bottle marked A before each new addition, and then proving, the acid be found reduced to the right proportion, i. e., *agreeable to the taste.* For adding the water, use the one-twentieth-quart vessel; take the proofs only out from A, and only so much as is necessary to taste it.

The acids of the must being sufficiently reduced, the contents of bottle B must be *accurately* measured, by which it becomes evident how much water has been added to the must, and *exactly* so much *sugar-water* has to be added to the must in wholesale that is to be improved. If, for instance, the mixture in B is $1\frac{6}{10}$ quarts, then to each quart of must $\frac{6}{10}$ quart of sugar-water is to be added; 60 quarts of sugar-water, that is, to 100 of must.

Now we have still to deal with another question, "Of how much sugar and how much water has the sugar-water to be composed?"

To answer this, we must ascertain the weight of 100 quarts of must or water. The following table will aid to find this out:

100 *pounds* (*Zollpfund*) *are equal to*

33 maas of Baden,	50 kans of Holland,
50 " Bavaria,	29 maas of Nassau,
54 quartier of Brunswick,	25 " Austria,
28 maas of Frankfort,	43 quarts of Prussia,
50 litres of France,	32 visirkans of Saxony,
51 quartier of Hanover,	33 maas of Switzerland,
25 maas of Electoral Hesse,	60 halbe of Hungary,
29 " Hesse-Darmstadt	28 hellaichmaas of Würtemburg.

We have farther to determine the *contents of sugar* of the must by *Oechsle's Must-Scale* and table. For instance, if this shows 68 degrees, the sugar contents, according to the table, will be 15 per cent. If it is to be brought up to 20 per cent., we have to add 5 pounds of sugar to every 100 pounds of must, and to every 200 pounds of must, therefore, 10 pounds of sugar. Of water (or, more properly, sugar-water), as we previously have shown, must be added 60 maas, or 120 pounds. Because this must contains 20 per cent. of sugar, therefore in 120 pounds of this will be contained 24 pounds of sugar. In the whole, therefore, 100 Bavarian maas of must require 34 pounds of sugar. These, deducted from the 120 pounds of sugar-water which must be added, it is evident that, of *water*, we have to add 86 pounds, and the sugar-water is therefore to be composed of 34 pounds *sugar* and 86 pounds (or 43 Bavarian maas) of *water*.

The Salts.

All combinations of acids with a "basis" are called *salts.* By

dissolving such a combination (for instance, common salt, or cream of tartar) in a fluid, and leaving it quietly in a warm place until this has evaporated, it will be a salt remaining in small crystals. The salts dissolved in must and wine are, however, very different, according to the ingredients of the soil on which the grapes grew. Besides cream of tartar, we know now yet sulphate of potassa, soda, tartrate of potassa, of alumina, tartrate of iron, chlorate of magnesia, and phosphate of magnesia. One and the same species of grapes can therefore, according to its native soil, contain, besides cream of tartar, also salts of different kinds, in a greater or smaller proportion. This furnishes another proof that no one of all forms a *necessary* ingredient of a good wine. A strong content of salts depends always on a very salty soil or the employed manure. A *very detrimental* influence upon the taste of wines have the salts of grapes that grew on a soil rich in nitrate of potassa, nitrate of lime, magnesia, and ammoniacal salts. The must of those ought always to be brought up to a sugar content of 28 to 30 per cent., in order to exclude a larger part of the injurious salts by increasing the alcoholic contents of the wine.

The main usefulness of some salts, as, for instance, cream of tartar, common salt, the bitter salts, is their imparting to the wine a softening, opening quality.

The Gummy (Slimy) Parts.

Their presence in the wine retards only their clearing off, wherefore it will always be prudent to remove them as much as possible before the fermentation by *clearing* off the slime from the must, thereby removing, at the same time, many other stuffs not destined by nature for the producing of wine, also the dirt and dust that may have fallen into it.

The same may be said of the "*gelatinic acid.*" Fortunately, it is partly removed by the fermentation, partly settling itself in the wine with the superfluous *kali* (potassa) and alkaline earths (lime), with which it enters into indissoluble combinations. By the cleaning process it is, for the most part, removed.

The Coloring Matter.

Only one kind of grapes is known that has a red-colored juice —the "Faerber grape." All others, whether red, blue, or black, have the red coloring matter only in their skins. Its nature is rosin, and therefore indissoluble in must as long as no fermentation of alcohol in it has taken place. For this reason, the red, blue, or black grapes produce only white wine if the skins are thrown out before the fermentation. If these, however, are allowed to share the fermentation, the alcohol forming during it will dissolve the coloring matter. This it does the more effectually, and the wine gets the darker, the more sugar the must contained (the more alcohol was formed). Besides this, the wine will turn

out the darker the less acids it holds, because these change the deep *reddish-blue* into *red.*

A *not too large* addition of water (with a corresponding of sugar) will therefore not reduce the color of the wine, but make it frequently appear darker.

By frequent connection with the air the coloring matter oxydizes, turns brown-red, and separates itself by-and-by from the wine. The filling of red wines from one cask into another ought, therefore, always to be attended with great care. By adding a little cream of tartar, the change of color may, however, be stopped, or itself renewed.

The *green* color of the white or yellow grapes is formed by a coloring matter, contained as well in the juice as skin, called "leaf-green," or "chlorophill." The reason why, out of green must, wine of more or less light or dark yellow color is produced, lies in the larger or smaller contents of lime of the soil that those grapes grew on.

The Nitrogenic Combinations and the Ferment.

These (vegetable albumen, etc.), perfectly dissolved in the must as well as wine, attain, under particular circumstances, the faculty of originating the fermentation by whose action (and this is about all we know) the must changes into wine. A great many of the yeast stuffs, not being consumed, remain, however, and our white wines especially appear to be apt to retain them in so much, often that, even after being kept for years, they will work again, and form anew a kind of fermentation. The *red* wines retain considerably less. The yeast stuff remaining in the wine effects, after all the sugar is dissolved, the alcohol in the same manner as the former, so that, as this by combination with oxygen forms the yeast, the alcohol with oxygen forms the acid of vinegar.

The Flavor Matters.

Besides the particular agreeable *wine smell* shared by all grape wines, some of them have still another flavor, similar to that of the grape blossom, generally called "*aroma, flower, bouquet.*" It only develops itself during the fermentation, and the more and stronger the richer the grapes were in sugar. It is probable that the alcohol of the wine effects greatly the so-called *bouquet stuff* (though this itself is as great a secret), as we know the more sugar in the must the more alcohol is formed.

The Extractive Matters.

These comprise all those parts of the wine that are *not volatile;* that is to say, the remaining parts of the wine after all others have evaporated, as water, alcohol, acid of vinegar, etc. The value of the wine is not affected by them, or only to a very small degree.

After thus examining the composing parts of the grape-juice and their main features, we justly conclude that none of them but the acids, the sugar, and the water are *indispensable* for the fabrication of wine, the others merely aiding.

VI.

PROGRESS OF WINE FABRICATION SINCE 1850.

In France we see a lady, Mrs. Cora Millet, a landed proprietress, taking the lead in adapting a rational manner to increase the quantity of the wine by more than five per cent. without harming its quality. Soon others, convinced by the good results, followed in the wake. In the year 1856 a distinct class was founded at the Royal College at Dijon, the capital city of the rich Burgundy district, for the instruction of students in the application of chemistry to the culture of the grape.

In this the different newly-invented methods of making and increasing the wine are clearly discussed and taught, inasmuch as they are based upon proportionate additions of sugar and water. A similar class was founded at Rheims, the capital of the Champagne district.

Gall's Procedure and Improvements.

The main principles upon which my system of *making very good medium wines*, *even from unripe grapes*, is founded, are:

1. All grapes have within themselves the materials necessary to produce wine.
2. These *materials* are sugar, water, and free acids.
3. Only perfectly ripe grapes have them in proper proportions.
4. All grapes less ripe contain too little water and sugar in proportion to their acids.
5. Must of not fully ripe grapes can be improved by adding the deficient water and sugar.
6. The other parts of the juice are always present in sufficient quantity.
7. The price of the wines is, in general, more regulated by a medium degree of acids of no more than six, and not less than four *pro milles*, than by a higher degree of alcohol than eight per cent.

The art of producing from grapes *not fully matured* a wine equally as good and of increased quantity as from fully ripe ones of the same locality and species, is therefore mainly founded upon the method of bringing the sugar, water, and acids of the must into the relations in which they would be in fully-matured grapes of one and the same kind and locality in a superior season.

It may not be out of place to review once more the feasibility

of the recommended method of improving and increasing the wine. As a main point, we have to bear in mind that we are obliged to calculate or find out the weight of the must and the water, because we can not otherwise determine the quantity of sugar and the acids. Let us now take, for instance, two kinds of must of different quality as an illustration:

The *good* one shall be composed of 262 pounds of sugar, 5.9 pounds of acids, and 732.1 pounds of water. The *inferior* one of 110 pounds of sugar, 9 pounds of acids, and 881 pounds of water.

We have here a wide difference in the three main materials, the latter must, compared to the former, containing too little sugar and apparently too much water, also by far too large a quantity of acids. In order to bring it up to the standard of the good must, and to know how much sugar and other substances we have to add, let us try to find out by a simple calculation:

(*a.*) *Query.*—If in a good quality of must 5.9 pounds of acids require 732.1 pounds of water, how much water need the 9 pounds of acids of the inferior?

Answer.—5.9 : 732.1 = 9 : 1116.76; or, leaving out the fraction, 1117 pounds.

(*b.*) *Query.*—If a good must holds 262 pounds of sugar to 5.9 pounds of acids, how many pounds of sugar do the 9 pounds of acids of the inferior require?

Answer.—5.9 : 262 = 9 : 399.65; or, leaving out the fraction, 400 pounds.

In order, therefore to be qualitatively equal to the good must, the raw one must be composed of

	1117 lbs. *Water*,	400 lbs. *Sugar*,	9 lbs. *Acids*.
It contains............	881 " "	110 " "	9 " "
And needs............	236 " "	290	

Making an increase of 520 pounds to the must, or more than 52 per cent.

A natural must of 72° Oechsle's Scale = 16 per cent. of sugar, and 5 per cent. of acids, may safely be considered the most proper standard by which to regulate the main materials of the inferior ones. Such a standard must has

160	pounds	of sugar.
5	"	acids.
835	"	water.
1000	pounds.	

VII.

GALL'S REFORMATIONS IN WINE-MAKING.

HAVING devoted, says Dr. Gall, considerable time and pains to experimenting on wines, and different methods of making and ameliorating them, I came, in the year 1828, upon the idea to try whether I could not produce a drinkable wine without using any grapes at all for the purpose; and, verily, I succeeded far beyond expectation. I took nothing but *grape-twigs* chopped into pieces, and allowed them to ferment with half an ohm of sugar-water. The result was a very palatable wine. This experiment proved to me that even *totally unripe* grapes have not only too much acids, but too little water and too little sugar in proportion to their acid parts, and that it would be an unwise policy to extract acids from a too sour must, but that water should be added instead, just in the same way as it is to be added to a must very rich in sugar to reduce its acids, and to make the wine produced from it drinkable. I believed, therefore, also, that the acids of the grapes were a very valuable part of them, especially in unfavorable seasons.

In subsequent years I madere peated experiments by adding sugar-water to musts, thereby not only increasing this in quantity by 20 and 30 per cent., but also improving their quality. In the district of Leutesdorf (which only produces in most of its sites a very inferior grape) I had, in the year 1831, six casks to experiment on.

I numbered them from A to F, their cubic space differing but slightly. A was filled with 6 ohm of must, pressed from grapes without selection: the sugar parts of it amounted to 15½ per cent.; B with 6 ohm of selected ripe grapes, with sugar parts of 17¼ per cent.; C with 5¼ ohm of must of selected ripe grapes, with an addition of 50 lbs. of grape-sugar: after this became dissolved in the must its sugar contents were 19½ per cent.; D with 6 ohm, made of the selected rotten and half-ripe grapes: its sugar part 13 per cent.; E with 5¾ ohm of the same quality of must as the latter, with an addition of 100 lbs. of grape-sugar: sugar contents 18 per cent.; F with 5 ohm of the same must, with an addition of ¾ ohm of water and 125 lbs. of grape-sugar: sugar contents 18 per cent.

After the fermentation was over, all the casks were filled up with wine of the same quality as that of A.

The next public sale demonstrated the benefits derived from this process. The following tables show the prices brought by the wines prepared by these processes, the gain actually realized, and that which would have accrued had all been similarly treated. The sums are expressed in Prussian thalers.

A. Natural wine	53
B. Wine of ripe and sound grapes	87
C. The same, with 50 lbs. of sugar	101
D. Of raisin-like and half-ripe grapes	26
E. The same, with 100 lbs. of sugar	68
F. The same, with 125 lbs. of sugar and ¾ ohm of water	82
	417
From this are to be deducted, for the picking out of the ripe grapes, for 275 lbs. of sugar, and for divers labor	30
Leaving for the 6 casks of wine	387
To which must be added the price of about ½ ohm of must saved by the addition of sugar	10
The total proceeds of the 6 casks were therefore	397
If these improvements had not been added, the 6 casks would have been like that of A, bringing (53 × 6)	318
The net gain, by improving the must, was therefore, in Prussian thalers	89

This gain would have been considerably larger if these improvements had been employed on all the grapes, as the following calculation shows:

For A, if treated in the same manner as F, at least the same price; an addition of	29
For B, if mixed with 50 lbs. of sugar, the same price as for C; an addition of..	14
For D, if treated as F, the same price; an addition of	56
For E, on the same supposition	14
Besides, 1 ohm of must would have been saved at A, ¼ ohm at B, 1 ohm at D, and ¾ ohm at F· three ohm in all, which, by the same treatment as at E, would have given	49
Total increase	162
Deduct from this the price of 500 lbs. of sugar that would have been added	46
And there would have been a gain of	116
Add to this the former gain of	89
And there would have been a *net gain*, by applying the improvement to all the 6 casks, of Prussian thalers	205

This would have been still farther considerably increased if the acid parts had been reduced to their proper proportions; but of this I had at the time no idea. It was not until the year 1850 that I published my essay "*On the Manner of Making very good medium Wines even from unripe Grapes*," and had afterward the satisfaction of receiving numerous written acknowledgments from many societies and individuals of its entire practicability.

VIII.

PREPARATIONS FOR THE VINTAGE.

Knowing that Nature does not in all seasons allow the fullest state of maturity to be attained by the grapes, and therefore the proper formation of the sugar parts, it becomes our policy to try at least to gain all of these out of them as far as possible. Better

Fig. 7.

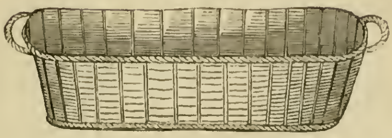


Fig. 8.

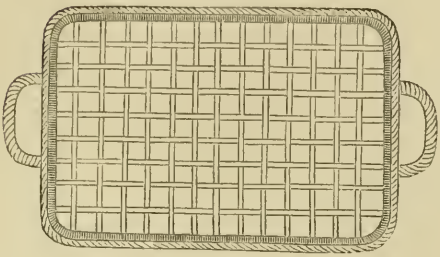
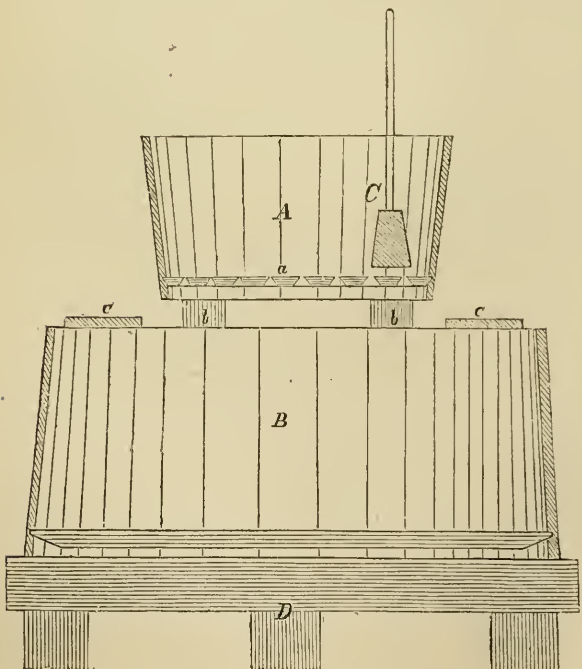


Fig. 9.



than by *pressing*, which always leaves a certain proportion within the grapes, we obtain this end by *extracting* it by water.

The simple apparatus for this purpose we find represented in *Fig.* 10 (page 276), in a perpendicular profile. In its main feature it is composed of a barrel standing upright, whose inner space is partitioned off by inlay-bottoms. These divisions are filled with musted grapes up to four fifths of their height, after which the must is let in under the sink-bottom A, through the tube *w*, *w*, that is connected with the funnel *x*, and so allowed to enter the interstices of the crushed grapes. After the barrel, which may be called the "*Extractor*," has been filled in this manner with must up to the height of the proof-tube *o*, water is passed to the must through the funnel, and this latter fluid will be pressed upward through the intervals of the grape residue and the proof-tube by the action of the water, that, without being able to mix itself with the must, takes its place in the same proportion as this flows out. Immediately after the last drop of the must has been driven out, the first drop of water will appear.

We will now see what farther implements have to be prepared in order to be fully in readiness to make the most profit out of the vintage:

One or more wicker baskets, to hold the gathered berries (*Figs.* 7 and 8).

One or two tubs (A, *Fig.* 9), to crush the grapes in.

Some *wooden pestles* (C, *Fig.* 9).

A copper or iron kettle, to boil the water in and dissolve the grape-sugar.

A chopping-form and a cutting-knife, to cut the grape-sugar that may be found in hard lumps.

A decimal-scale.

Baskets with two handles, and numbered, to hold the cut sugar.

Tin buckets, skimmers, and dippers.

Two small hand-tubs, to carry the sugar solution to the barrels.

A portable ladder, with five or six steps, to be placed on the tubs.

A whip to stir and beat the sugar solution into the must.

The necessary number of fermentation-tubes (*Fig.* 13, and *u*, *Fig.* 10).

A thermometer.

A must-scale (*Fig.* 1, page 257).

An acid-scale (*Fig.* 3, page 264).

A spirit lamp, with a small tin pan to heat the must whose acids are to be examined.

After all these instruments are properly cleaned, and the necessary barrels put in their places, these are numbered A, B, etc., and a book is made with a separate leaf for each barrel to hold the respective notices thereon.

IX.

THE OCCUPATIONS IN THE PRESS-HOUSE.

HERE we have the task of transforming the grapes which we receive from the vineyard into the most adapted state for producing wine. Three principal operations will be wanted to bring the grapes to fermentation in either a crushed state, as "*mash*," or their juice only as "must:"

1. The *picking off* the berries from their pedicles.
2. The *crushing* of the grapes.
3. The *pressing*, which is either done before or after the fermentation, to gain as much as possible of the wine, in the first instance as "must," in the latter as "young wine."

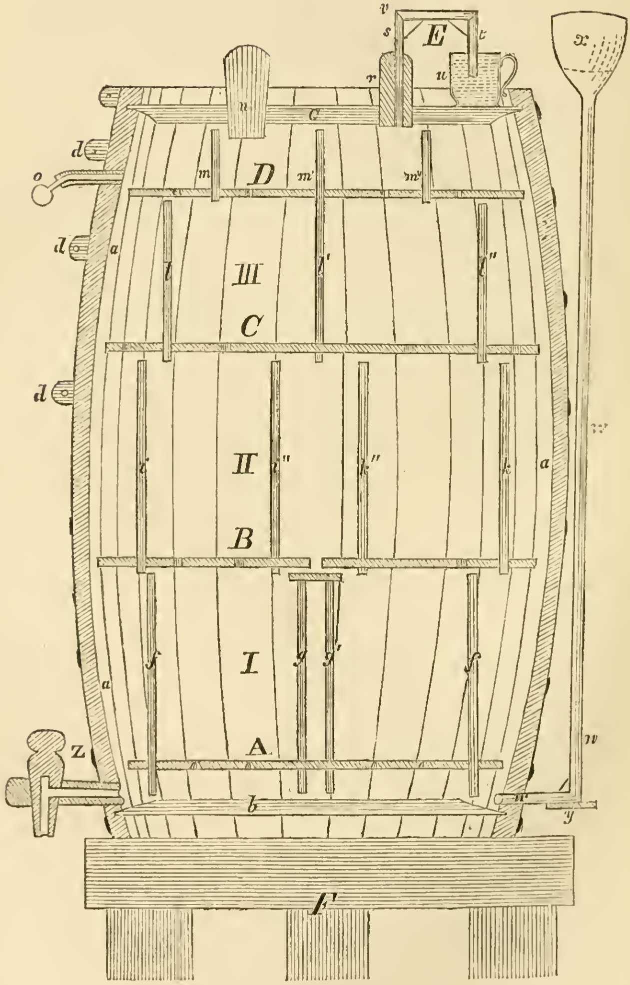
Dr. Gall says: I am of the opinion that the picking off of the berries ought always to be done, if the skins and seeds are to share the fermentation in the employment of a sugar and water addition. I also consider it prudent to allow the "combs" to ferment only partially, and to draw off the young wines from the husks not later than fourteen days after the main fermentation has set in. Experience has shown that wines that had fermented with the "combs" left when still green, kept, even for a year after, a peculiar taste, owing, it seems, to a particular bitter, not easily soluble matter therein contained, besides the usual tannic acid. Many wine districts do not crush their grapes at all, but bring them directly from the vineyard to the press. Under all circumstances, it seems, however, preferable, and especially recommendable if the crushed grapes are to ferment in closed vessels.

The manner of crushing the berries differs a little in regard to white and red ones, and according as one wants to produce only juice wine, or also husk wine. We will here only consider the management of the white grapes.

The "crushing apparatus" (*crusher*), *Fig.* 9, page 273, is composed of the "*crushing-tub*" A, of about 3 feet diameter and 20 inches high, whose bottom is perforated by about 150 holes, each 2 inches wide. These latter have to be burned out with a red-hot iron to an upper width of $2\frac{1}{2}$ inches, and a lower of 4 inches. The tub rests upon two blocks (*b*, *b*) above the "*juice-tub*" (B), upon which, on both sides of tub A, foot-boards (*c*, *c*) are placed for the man that has to crush the berries by the aid of a wooden pestle (C), avoiding, however, as much as possible the breaking of the seeds.

If only the juice of the grapes is wanted, it needs but to bring the vineyard into the receiving-tubs, and from these into the crushing-tub, in such portions as are wanted. After the grapes have been crushed, the husks are taken from the bottom and carried to the press. The juice here produced is then put into the

Fig. 10.



THE EXTRACTOR.

barrels destined for it, and either mixed at once with the sugar necessary to improve it, or, which appears better, this may be done *after* the main fermentation is finished. In both cases, each barrel has to be provided with a *fermentation-tube*, and left to its action.

Otherwise the husks can be *trodden* into their respective barrels as soon as a portion is crushed out. It is also well to do this at once, because if it is well done they will keep for several months, and yet make a good husk wine.

The Manner of Extracting.

A different method is employed in cases when from white grapes not only juice wine is to be made, but the husks also used, when still fresh, to produce husk wine.

We will first give a little closer description of the already-mentioned apparatus (*Fig.* 10) necessary for this: *a a* are the sides of the barrel in profile; *b*, its lower, *c*, its upper bottom. The four upper hoops are connected by screws (*Fig.* 11). By loosening these four screws a little, the staves separate so far that the upper lid, *c*, may be easily taken out and readjusted. *Fig.* 12 represents a section of the lid, *c*, and of the staves, *a*. When the edge of the lid has been placed in the groove, *e*, of the staves, a slip of gutta percha about two inches wide is inserted in the joint so as to close it effectually, and the screws are tightened.

Fig. 11.

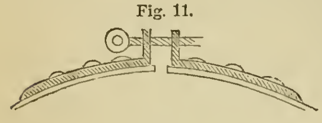
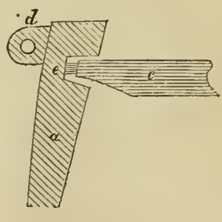


Fig. 12.



The inner space of each extracting barrel is divided into three compartments (*Fig.* 10, I, II, III) by four movable bottoms (A, B, C, D). The upper sides of three of these inlay bottoms are shown in *Figs.* 15, 16, 17, the letters corresponding with those of *Fig.* 10, p. 276. *Fig.* 15, A is a sunk bottom, with six sticks, round or square, fixed therein. These sticks are one inch thick, and from twelve inches to twenty inches high, according to the size of the barrel ($f\,f'$, $g\,g'$, and $g''\,g''$), by which this bottom is held at the distance of two inches above the natural bottom, and at the same time the middle bottom (*Fig.* 16), composed of two halves, B and B, gets support. The sticks g and g', as well as g'' and g''', are therefore united to one another by the small boards $h\,h'$. Each of those two parts, B and B, has three sticks, i', i'', i''', and k', k'', k''', fixed into it, in order to support the bottom C, which also has four sticks, l, l, l, l, for supporters of the lid D, *Fig.* 17. This latter only serves to keep the husks that, after the fermentation begins, are apt to rise, steeped in the fluid. For this purpose D has also four sticks inserted, m, m', m'', m''' (these,

Fig. 15.

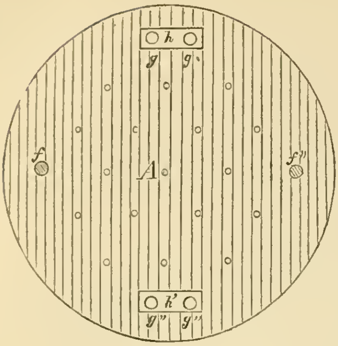


Fig. 16.

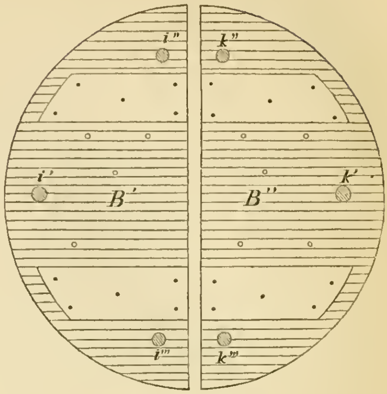
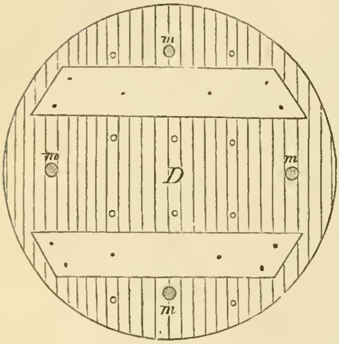


Fig. 17.



however, being but one sixth part of the inner height of the barrel); *n* is an orifice closed by a bung, in order to allow a hand to pass through to get hold of the bottom *a*, either to take it out or replace it. At *o* there is a *proof-tube*, in equal height to the upper level of the lid. *Fig.* 14 shows the same on a larger scale: *p* is a faucet-shaped hollow tube, with a tenon, *q*.

Fig. 14.

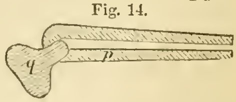
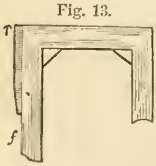


Fig. 13.



Into a second opening of the lid *c* a perforated bung is fixed (*r*), into which the two-shanked fermentation-tube E (shown in *Fig.* 13 enlarged) is inserted, with its longer part, *s*, having the shorter one, *t*, dipped into the vessel *u*, filled with water; *v* is a small iron rod soldered to the angle of the part *s* of the tube, serving the purpose, if necessary, to drive by blows the tube faster into the bung *r*; *w* is the extraction-tube, of strong sheet iron, one and a quarter inches wide, and furnished with a funnel ten inches wide, which enters the extraction-barrel with its angle-shaped end below the sink-bottom A, and serves to extract the ley of the husks in a shorter time, and more efficiently than it could be done without it; *y* is an iron rod like *v*. The funnel *x* contains inside a sieve with many small holes, to keep back the particles of the husks. Z is a wooden faucet; F is the support of the extraction-barrel, twelve to fourteen inches high.

We will now proceed to the manner of extracting itself. The first business would be to place the barrels so that the bung-holes

are turned to the front. After a portion of the grapes are crushed, the remains of them have to be thrown upon the sink-bottom A. and this is continued until the first partition is filled to about four fifths of its height. Then bring the inlay-bottom, B′ B″, with its upward tending sticks, upon the sticks of sink-bottom A, unscrewing the hoops a little. After these tightening again, continue the introduction of crushed grapes to the height of four fifths of the second division. Now bring also up the *must* contained in the juice-tub B, *Fig.* 9, so much into the barrel through means of the extraction-tube, *w*, as will be necessary to fill the part I entirely. When the partition III has been filled in the same manner as I and II with crushed grapes, and the lid D been placed, insert also the natural bottom *c*, and fix the gutta percha slip into the seam of the barrel, in order to tighten it; tighten the screws, place the fermentation-tube, and fill the vessel with water.

Not before all this is done may the extraction-barrel be filled with the necessary quantity of must, which is done by pouring it into the funnel of the extraction-tube, while the proof-tube *o* remains open until it appears in this latter, which after this must be closed.

After about two hours' time it may be opened again, in order to draw off into buckets about one tenth part of the must through the faucet. When this is now closed again, the drawn-off must is re-filled through the extraction-tube *w* into the extractor, and now the must may be entirely drawn off into those barrels in which it is destined to ferment, either in its natural state, or with the necessary addition of sugar and water.

We proceed now to the extraction of *the grape remains* by the application of water. To show how this may be done in the most practical manner, let us change the proof-tube *o* for a brass faucet $\frac{3}{4}$ wide (extract-cock), and place beneath this a receiving-tub. After this, we fill the extraction apparatus with *clean water*. in the same manner as was before done with the must, by pouring it into the funnel until it appears as a clear fluid in the extract-cock. When this has been sufficiently done, stop the cock, and bring the produced extract to the must in the barrel. The first operation, of introducing the must and water below and drawing it off above, may be called "extraction by removal;" the latter, by bringing the fluid to be used for extracting into the apparatus at the top of it and drawing it off at its foot, the "extraction by filtration."

Returning to our operations, we have, after acquiring the necessary quantity of extract by two or three manipulations, knowing the apparatus still to be filled to the cock, to repeat the experiment in order to gain the remaining fluid by continuing to fill water into the funnel *x*. This extract we put, however, into a separate barrel, and add directly about six per cent. of grain or dissolved sugar. The still full extraction-barrel remains so for

six or eight hours, until we take a proof from the faucet as well as the cock. If there is no difference in the taste of these, we may draw the fluid off by the faucet; otherwise we have to repeat the filling, and not until then to draw off by the faucet, and to put this, according to its quality, either to the husk-wine extract, or to keep it in a separate barrel, to be used, instead of water, for subsequent extractions. The remaining husks themselves are of no farther use.

Besides the manifold advantages offered by this method of extraction, by means of an upward removal and pure water only, the following may be considered: Its allowing a rapid gain of the juice; the extraction of *all* the valuable ingredients of the grapes; that, of the sugar to be added, nothing can remain in the husks nor in the yeast, because it is not mixed with the young wine before the first draw off.

After the performance of this labor, the principal object is to determine the quantity of the sugar and acids of the grape-juice, which can be done either directly or indirectly.

Directly it is done by proving the fresh must itself by means of the scale. It is, however, better to do it *indirectly* by allowing the must first to ferment, and to find out the weight of the alcohol after the first draw from the yeast by means of the "*vaporimeter*," and from this to determine the sugar quantity, counting each per cent. of alcohol as two per cents. of sugar. As, however, either *Geisler's Vaporimeter* or *Talleron's Alcoholometer* might cost too much for most grape-growers, the best plan would be to weigh once a day, during the time of the vintage, the juice of the grapes, to note this down regularly, and to adopt the average number of these notices as the quantity of sugar parts for the season.

The quantity of acids is best calculated on one and the same day of all the produced must. Of this about a quarter of a pound is to be heated to the boiling point in a small tin pan, in order to evaporate the oxygen originated by the fermentation, and then to be cooled down again to 20° R.

Improving the Natural Product.

This is best undertaken *after* the first main fermentation has taken place. The fermented must has to be quieted still more for several days, to allow the yeast matters to settle perfectly, which may be accelerated by burning sulphur in the vacant space of the barrel. Now the grape-sugar has to be reduced to its *true sugar weight*, and to add to this the wanting quantity (for instance, 20 pounds to 100 pounds of lump sugar, 12 pounds to 100 pounds of grain, and 8 to 100 pounds of pulverized). If this latter, or grain sugar, is to be used, it only needs to put the calculated quantity of water, sugar, and must into the barrel, and leave it to ferment. If lump sugar is used, it must first be dissolved in a part of the water to be mixed with the must, by boiling this (about

one pound to three pounds of sugar) in a kettle, and throwing the sugar in little by little.

As the mixture of sugar and water may be done *ad libitum* before or after the main fermentation, we will, in our calculation, here prefer the first. Suppose we have taken book-notices of the quantity of sugar and acids of the must in all the barrels. By these we see now that, for instance, the barrel A has a cubic space of 1000 litres, and, in order to leave a vacant space of 40 litres for fermentation, we had filled it with 960 litres or 1920 pounds of must, of 14.2 per cent. of sugar, and 8.5 pro milles of acids:

The barrel containing in all		1920 lbs.
There is of sugar $\left(\frac{1920\times 14.2}{1000}\right)=272.64$ lbs.		
" acids $\left(\frac{1920\times 8.5}{1000}\right) = 16.32$ "		288.96 "
Leaving of water and indifferent matters		1631.04 "

Wishing now to have wines of 5 per cent. acids and 8 per cent. of alcohol (=16 per cent. sugar), and such a wine having in 1000 pounds of must 160 pounds of sugar, 5 pounds of acids, 835 pounds of water, the questions arise: How many pounds of water do 16.32 pounds of acids require, if 5 pounds of these presume 835 pounds of the former? *Answer:* $(5:835=16.32:x)=2.725.4$ pounds of *water;* and, How many pounds of sugar to the like quantity of acids, 5 pounds of acids requiring 160 pounds of sugar? *Answer:* $(5:160=16.32:x)=522.25$ pounds of *sugar*.

The acids of the must in the barrel A therefore require	2725.40 lbs. of *water*,	522.25 lbs. of *sugar*.
The must already contains	1631.04 " "	272.64 " "
There is therefore to be added	1094.36 " "	249.61 " "

In case lump sugar is used, which contains only 80 pounds of dry sugar in 100, and 20 pounds of water, we have farther to ascertain, How many pounds of it are necessary to compensate for 249.61 pounds? *Answer:* $(80:100=249.61:x)=312$ pounds. Against the calculated 249.61 pounds of dry sugar we want therefore of lump sugar 61.39 pounds more. As 312 pounds of this contain, however, the same quantity of water too much as too little of sugar, it becomes necessary to add so much less water, viz., 61.39 pounds. We have therefore virtually to add 1032 pounds of water and 312 pounds of sugar. The result will be:

The barrel A containing already of must		1920 lbs.
Water to be added	1032 lbs.	
Sugar	312 "	1344 "
This will give of improved must		3264 "

By measure, therefore, we shall have:

Must already in the barrel		960 litres.
Water to be added, 1032 lbs. (2 lbs. = 1 litre),	516 litres.	
Sugar " " 312 " (3 lbs. = 1 litre),	104 "	620 "
Requiring a cubic space of		1580 "

But, as we have to leave a space of 40 litres free in the barrel for fermentation, we have now to calculate how much must we have to take from it to gain the room wanted for the sugar and water additions. As 1580 litres of improved must are to be produced from 960 litres of the original must, how much of the latter is to be left in the cask? *Answer:* (1580 : 960 = 960 : 583.30) = 583 litres, to be left; and as the barrel contains 960 litres, we must take away 377 litres. And again: If 960 litres of must require 516 litres of water, how much will 583 litres require? *Answer:* (960 : 583 = 583 : 312.60) = 313 litres. And farther: If 960 litres of must require 312 pounds of sugar, how much will 583 litres require? *Answer:* (960 : 312 = 583 : 189.38) = 64 litres. In our note-book we have to make the following entries:

Of the contents of barrel A	960	litres.
We have to take out	377	"
Remaining	583	"
To this is to be added, water	313	"
" " " sugar	64	"
The barrel will therefore again contain	960	"

It will, however, be found more advantageous to make this improvement *after* the main fermentation. In this case we have to begin with putting the sugar-water into another barrel, and to add it to the young wine (in the above example 583 litres) at the drawing off of the yeast. The yeasts remaining in the various barrels are put into one barrel, mixed with an equal quantity of sugar-water (of 20 per cent. sugar parts), and left to ferment. The wine coming out of this is best adapted for filling-up purposes.

The next draw-off of the improved wines takes place best when they begin to clear off. The barrels, as soon as they may be safely bunged, must be kept full by regularly filling up: in the first year, three times; in the second, twice; and every subsequent one drawn off from their sediments.

The most efficient substance used for *clearing* red and white wines is a gelatinous composition known and extensively used in France under the name of "*Gélatine-Lainé.*" Its efficacy is indeed surprising.

X.

THE METHOD OF DÜBRUNFAUT AND PÉTIOT TO INCREASE THE QUANTITY OF WINE.

The eminent technician, Mr. Dübrunfaut, promulgated, for the first time, in the year 1854, in France, his opinion, based upon many trials:

That an addition of sugar-water to the must, regulated accord-

ing to the quantity of its acids, will be the unfailing means to produce from every vintage, no matter of what locality, always wines of like quality as those of the best seasons, and to quintuple their quantity if necessary.

The proposition of Dübrunfaut was carried out in the largest measure the year following by a Mr. Abel Pétiot de Chamirey, a large vineyard proprietor in Burgundy, and an essay on the manner employed and its results was handed by him to the Imperial Society of Agriculture. In this the gentleman says:

At the vintage of 1854 I was fully convinced that one may at least double the quantity of wine by adding sugar-water to the must or husks equal to the quantity of grapes. That farther, this article must be durable, because of its having all the substances necessary for keeping it so, and less of those that might tend to spoil it.

I commenced my experiments, and found the results surpass my expectations. Of a quantity of grapes that by way of ordinary procedure would probably not have given more than 60 hectolitres of wine, I received 285—almost five times more.

I proceeded as follows: After the grapes had been crushed, and still before the fermentation, I drew off all the fluid that could run off without being pressed, and got a white, very good must indeed. In this manner I drew off 45 hectolitres. This juice weighed 13 degrees by Chevalier, and, to give the sugar mixture an equal density, 19 kilogrammes (38 pounds) of refined sugar were required per hectolitre (200 pounds) of water. I replaced now the 45 hectolitres of juice by 50 hectolitres of sugar-water in the tub, left it to ferment, and drew off three days later 50 hectolitres of splendid red wine. In order to try the experiment still farther, I renewed it several times. At the second time I replaced the 50 hectolitres by 55 hectolitres of sugar-water at 22 kilogrammes, and drew the same quantity off after the fermentation was over, only two days later. At the third trial I took 55 hectolitres of sugar-water at 23 kilogrammes; the fermentation lasted hardly two days, after which, pressing the grapes, they gave 60 hectolitres of wine. The remaining husks I put anew into the tub with 35 hectolitres of sugar-water, left them to ferment, and made 39 hectolitres. Finally, I put the first natural *white* wine into barrels only half full, and filled them up entirely twelve hours later by water sugared to 18 kilogrammes. Those different fluids resulted in—

Fermentation.—At the four operations with sugar-water very strong. The first lasted the longest, and the last the shortest.

Color.—The third tub had the most, and the fourth, made of the husks, the weakest.

Alcohol.—The natural wine held 12 per cent.; the sugar-water wine, of 18 kilogrammes sugar, 13 per cent.; that of 22 kilogrammes, 15 per cent.; and that of 25 kilogrammes sugar, 17 per cent.

Taste, Bouquet.—The wine produced by the aid of sugar-water was less acid, and had more flavor (bouquet) than the natural wine; in short, it was better.

Durability.—In all respects satisfactory. I sent of this same wine to New Orleans, and it arrived there in a clear and perfect state.

Of the vintage of 1855 I made, instead of 285 hectolitres of wine, 5000 by this manner of operation. Sometimes I varied this slightly. I renewed on certain tubs the mixture of sugar-water *eight* and *nine* times, viz., two operations with *white* wine *before* the fermentation, two with fermented *red* wine, and four or five with more or less colored white wine. The fermentation was always sufficient to let the sugar-water of ten degrees quickly fall to the 0 point. When this takes place, all the sugar is changed into alcohol, and the drawing off must begin.

Gall's Experiment on the System of Pétiot.

. . . After receiving the information of this splendid success attained by Mr. Pétiot by the aid of his system, I concluded to give it myself a trial. I bought, therefore, in the Könen district, famous for the quality of its red wines, a quantity of husks from one of the best sites which had gone already through the fermentation, with but a small portion of pedicles mixed, the air having been excluded. At the drawing off of the juice, it resulted in 168 quarts of clear wine of 8.8 per cent. of alcohol and 6.1 *pro mille* of acid parts, and I supposed that about 30 quarts remained in the husks. I had now to these 220 quarts of a solution of sugar of 24 per cent. added (grape-sugar of 84 per cent. of dry sugar). The fermentation set in immediately in a cellar of twelve degrees temperature. In the month of March the wine was drawn off and the husks pressed; the result was 248 quarts. The husks retained, therefore, after the first drawing off, 28 quarts; consequently, there had been produced,

Grape wine (168+28)	196	quarts.
Sugar-water wine	220	"
Total	416	"

The acids, which must have been reduced to exactly three per cent. by the sugar solution, proved to be four *pro mille;* consequently only one *pro mille* was still received from the husks. This same wine, after keeping it for about two years, required such an exquisite aroma, fine taste, and brilliant color, that it struck every body as quite extraordinary.

Application of the "Extractor" to Pétiot's Method.

The "extractor" may serve as "fermentation-tub" when red grapes are worked up by Pétiot's system, to produce four times more wine. To this end, our drawing shows it with a fermentation-tube and a water-vessel. Its inner construction has to be slightly changed for the purpose, so that the distance between A

and B be one fifth, from B to C one fifth, from C to D one fifth, and from D to the upper lid *c*, two fifths of the total inner height of the tub.

If the juice only of the *red* grapes is required in a pure uncolored state, they must only be *pressed*, not *crushed*. The residue is taken to the extractor, and its three divisions are filled to three fourths of their height, and the lid (*c*) put up. At the same time, the must gathered in the juice-tub is put into its destined barrel and measured. An entry must be made in the book of how much juice has been produced from those grapes whose husks are in the extractor. The same quantity of sugar-water of like per centage has now to be put into the extractor through the tube *w*. Next measure exactly by a stick thrust through the bung-hole *n* in the lid what height the fluid has atttained. On the same level with this a hole must be bored through the staves, into which the sample-cock *o* is inserted, closed by its stopper.

After the main fermentation is over (which may be known when no more gas-bubbles rise through the water in the vessel), a sample must be taken at the sample-cock. In case the color of the young wine satisfies, draw it off, and put it directly into a barrel. If it be wished darker, open the bung (*n*), insert a funnel with a perforated mouth, and draw about half of the fluid off by degrees and return it to the tub, thus producing a cleaning or washing out of the coloring matter in the grape residues.

Then the wine is all to be drawn off and put into barrels, as *second* product (the *first* was the colorless juice). The extractor is now refilled through the tube *w* by sugar-water (the *second* infusion) of the like sugar per centage as the first up to the sample-cock, and after the fermentation, which begins at once, has subsided, operate just as before; draw the wine off (as *third* product), and put it into barrels. Likewise a *fourth* may be gained, but it would be wise to keep this apart. The husks can then be taken from the extractor and pressed in the usual way, and the wine thus produced be mixed in equal parts with the second and third product.

XI.

FERMENTATION AND ITS PRODUCTS.

Fermentation in a High Temperature.

Of *Fermentation* but little more is known than its action and its effects. We see and follow its progress while it begins to operate at a medium temperature of 10° R. in the room, when the wine gets cloudy, turbulent, and finally loses its sweet taste, producing by the process of change a spirituous, intoxicating fluid.

But very few know besides that during its action originate two distinct new agents from its *sugar parts* that had not been present in the must, viz., *alcohol*, remaining in the product and imparting to it its strength, and *oxygen*, which chiefly evaporates. But the real cause that transforms the sugar parts into these—or, rather, in the case of grape fermentation, into *wine*—is still a profound secret.

In the following paragraphs Dr. L. Gall proposes to give some contribution to the knowledge of the *conditions* under which those actions take place in the most perfect way, if by them wine is to be produced:

The fermented *must* becomes *wine* not before all those parts have been secreted that do *not* properly belong to the latter and peril its durability. It does this, indeed, by itself in the course of time; but it must be a main object of modern industry to produce such an end not only *well*, *but* also *cheaply*; *i. e.*, avoiding as far as possible the expenditure of capital, material, time, and labor.

A mean temperature of 10° or 12° R. was formerly generally considered sufficient for the whole period of the fermentation of must. Numerous facts prove, however, that this can not be considered as a proper standard, as it has been observed, as Chaptal mentions, that, according to experiments made by Mr. Poitevin, the heat originating in a certain quantity of grapes increased within five days to 26¾ per cent., and the fermentation ceased after fourteen days at 22 per cent.

From this we may draw the following consequences:

1. That larger quantities of grapes, very rich in sugar, attain a heat of 26¾ per cent.; this temperature, consequently, has to be taken as the most favorable for fermentation.

2. That as the heat of the fermenting must originates by the changing of the sugar into alcohol and oxygen, thereby developing warmth, this necessarily must reduce itself by degrees as less sugar remains to decompose.

3. That it is policy to aid the natural fermentation toward its end by gradually *increasing* the temperature of the fermentation room (locality), and, on the contrary, protect it from *cooling off*.

Many experiments by Dr. L. Gall and others have settled it that:

1. The mash of *red* grapes of 18 to 25 per cent. sugar heats itself (when the outer air is excluded), at a temperature of 14° to 15° of the mash-room, up to 20° to 23° R.; the must of *white* grapes of like sugar per centage only to 20° or 21° R.

2. That the fermentation falls off as soon as, at an equal exterior temperature, the warmth of the fermenting mass sinks 2° or 3°; but after two or three days (so long as all the sugar is not yet decomposed) begins anew, continuing for several days more if the secreted mash is stirred up again with the whole mass.

3. That the fermentation appears to finish sooner, and all the

sugar to be dissolved, if, from the second or third day after the audible fermentation sets in, the temperature of the fermentation room is gradually increased to 22° for *must* and 20° for *mash*, and kept at this degree until the former dies off.

This procedure effects sufficiently the secretion of the so-called "*yeast matters*" in an oxydized state as "*yeast*," and other ingredients not properly belonging to the wine, in a shorter space of time, and more perfectly, than they would otherwise for themselves (frequently not before years).

We know it is our main object to free the wine as soon and as well as possible of all the albuminous matters that it contains, partly in the shape of "*yeast*," partly as "*yeast matter*." It might, therefore, be highly advantageous to interrupt the heating process for a couple of days, in order to give the yeast time to settle sufficiently, then to draw the wine off from this into another barrel, and increase the heat again to its former point. A new portion of *matter* has now been transformed into yeast, whose operation will soon be visible by a new fermentation, after the quieting down of which a considerable sediment will be found in the barrel.

It would be recommendable to leave as long as possible that temperature to the fermenting fluids which they obtain by themselves during the main fermentation, or we should at least take care to prevent the cooling off of the fermenting-tubs by the action of the surrounding colder air. To do this, the interval between the supporting blocks and the floor and the bottom of the tubs are to be well filled out by straw, and the tubs themselves, being filled with the crushed grapes, wrapped round with straw-cords about the thickness of an arm, besides being clothed over with straw to the thickness of half a foot, tied by strong twine. The upper lids ought likewise be covered with straw or mats of this material. The doors of the fermenting-room ought only to be opened when necessary, and the windows closed for the night by straw bundles.

[These remarks have particular reference to a cold climate like that of Dr. Gall's country.—A. H.]

Advantages of close Fermentation.

Acetic acid is not to be met with in its natural state in any *grape-juice.* We find it, however, contained in all *wines.* How, then, does it originate in them? The simple answer we have in the fact that whenever the alcohol of the fermenting must comes into contact with the air, it attracts oxygen from it, and so transforms itself partly into acetic acid, which consequently spoils or destroys the taste of the wine. And by what is this combination allowed to take place? We answer, By the custom of allowing the fermentation of grape-must in *uncovered tubs.* This simple fact speaks for itself. Witness only the procedure by which vinegar is manufactured. The same relation it bears to the wine.

To prevent, therefore, as much as lies in our power, this possibility, we should principally employ *open* or *uncovered* tubs for the fermentation. Besides, two more advantages are connected with it: We guard against loss in *quantity* and *quality;* the first by evaporating (being sucked in by the outer air), the latter by getting insipid. The adapting of a tub for this purpose is very simple indeed. The whole apparatus needs but a tub (or barrel) put upright (like the one in *Fig.* 10), with the fermentation-tube (viz., same as in *Fig.* 10).

This latter is indispensable, because it makes it possible to proceed with the fermentation in air-tight space *without peril.* The oxygen gas emanating from the sugar would likely burst even the strongest barrel, if an outlet were not provided. This it finds now through the tube *s t*, while the water in the vessel *u* hinders the outer air from entering into the barrel in the reversed way through *t* and *s*. In order to ferment *red* grapes in an air-tight barrel, no more is therefore wanted but a top-bottom (lid-cover) like D (*Fig.* 17) and a fermenting-tube, E (*Fig.* 13).

We will now proceed to acquaint ourselves with the products of the fermentation, *i. e.*, the wine, and those parts of it that were not yet contained in the must, and were only originated during its fermentation. These are, *Alcohol*, *Carbonates*, and *Acetic Acid.*

The Alcohol.

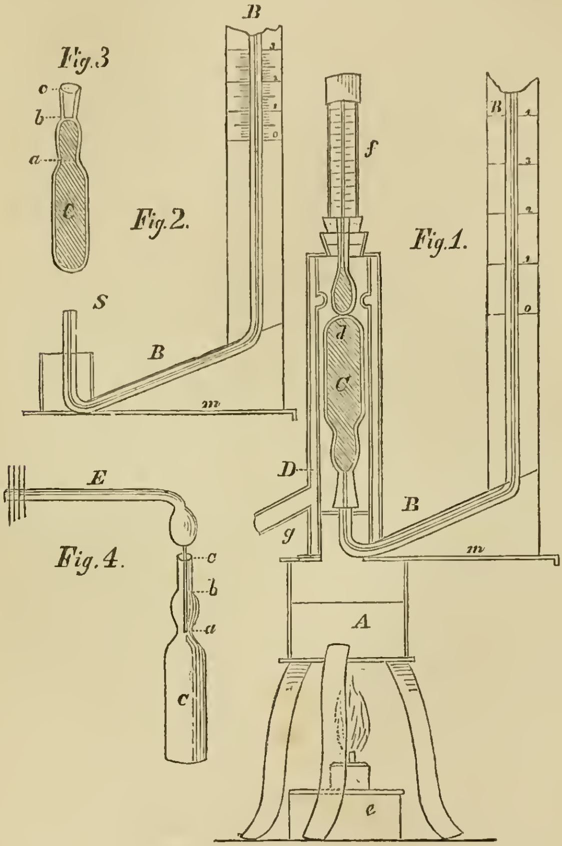
This forms one of the chief ingredients of all spirituous beverages, out of which it may be secreted, by distillation, as a clear fluid, very volatile and combustible, of rather pleasant smell, and an acid, burning taste. It is lighter than water (791 pounds of alcohol occupy but the same space as 1000 pounds of water). Taken in *small* quantities, it may safely be considered as rather a stimulant to the body. It has the quality of crippling and suppressing the fermentation; so much so, that highly-concentrated alcohol will prevent the yeast from creating or keeping it up. The best ally of the yeast is *warmth;* and in the same degree that this leaves it, it has to yield before its enemy. This fact should be another hint to us to aid the yeast in its battling with the alcohol by the application of outer warmth.

The strong acids contained in the wine decompose it in process of time, at least partially, or combine with the alcohol, making it still more volatile, and the base of the spicy flavor of the wines.

We have now to answer the question, *What degree of alcohol is required by a good quality of wine?*

A fact undisputable is that, although alcohol forms not the chief factor of the value of wines, yet, in case of equal bouquet and acids, those of the same locality, grape species and vintage, are always the most praised that contain the greatest amount of alcohol, or are the most fiery. As the composition of the perfectly-matured grapes has already taught us to leave to our wines at the utmost

6 per cent. of acids, so it should also admonish us to give them at least 24 per cent. of sugar, and by this about 12 per cent. of alcohol. We should, however, never go beyond 14 per cent. of it. Quite sufficient for the greater part of the home-consumed wines is 8 per cent.



The Vaporimeter.

The Vaporimeter.

This instrument is invented by Mr. Geisler, an eminent optician at Bonn. The accompanying cut shows it in one third of its size. Its four main parts, A, B, C, D, must be put together, when wanted, in the manner represented in *Fig.* 1. A is a small steam-boiler standing upon three feet, half filled with water, and heated by the spirit-lamp (*e*) underneath. BB is a double-bended glass tube, which is fixed upon an angular brass plate (*m*), together with a scale belonging to it. This plate can be moved upon the vessel A, and fixed on it. C is a strong glass vessel called the *quicksil-*

ver cylinder, filled with this material up to the division line *a*; its conical-shaped neck (*b*, *c*) fits so exactly and tightly over the end (S) of the glass tube B, that it can be moved upon it to the division line *b*, and connected in such a manner with the inner hollow of the tube B, that the contents can *only* enter from C into tube B. *Fig.* 4 shows the cylinder also in full profile, as well as a small angular elevator, E.

D is a brass cylinder of double sides, having in its upper part a very sensitive thermometer (*f*). This cylinder fits air-tight and steam-tight over a brass ring soldered to the foot-plate of the part B, and, when the instrument is used, is placed over the upward-tending ring. Its object is to take into its inner hollow the steam rising from the vessel A, and to keep them in connection from all sides with vessel C.

The space between the double sides serves to prevent the cooling off of the vapors that finally find an outlet through two openings in the upper part of the inner sides, and escape by means of the tube *g*. The thermometer *f* has only 5° of the 100° scale, viz., from 97 to 101, subdivided into ten parts, so that the rising of the quicksilver can be observed to one tenth of a degree. In order to show the manner of experimenting on it, let us make a trial with water.

We first lift the brass cylinder D, with the thermometer fixed to it, off from the steam boiler, and put it on one side. After this we loosen the part (*Fig.* 2), and take it off, holding it perpendicular, but without taking the quicksilver cylinder C previously off. Now we put our left hand underneath the foot-plate *m*, take hold with our right of the quicksilver cylinder C, and turn the whole round in such a manner that the tube-end S (in our drawing pointed upward) gets a perpendicular downward position. In this we draw the cylinder C off from S, and take it into our left hand, having laid aside part 2.

C is filled up to *a* with quicksilver. When used, we fill the space between *a* and *b* with the fluid we wish to prove. For this purpose we have the small elevator E (*Fig.* 4).

We fill now the boiler A half full of water, and light the lamp (*e*), and while this boils rearrange the instrument. By degrees steam will evaporate from the water in vessel D. This steam, shut in by the cylinder C, now presses upon the quicksilver, and pushes gradually so much of it out from it into the tube BB as is necessary to find room for itself. This point is indicated by the division line 0 of the scale. When the quicksilver has attained this, it will not rise any more. A quantity of pure *alcohol*, equal to that of water which we have put into the cylinder, requires a still larger space to expand itself into steam. It drives, consequently, the quicksilver *higher* than the steam of water.

Upon this power to expand is based the applicability of the vaporimeter to determine very exactly by per cents., even one

tenth and one twentieth per cent., of the real alcoholic parts of certain fluids (as wine, beer, vinegar). The scale at the tube BB is therefore divided into one per cent. and one tenth per cent. lines, bearing the numbers 1, 2, 3, 4, 5, etc. When the quicksilver rises to the line 5, we know, consequently, that the fluid contains in every 100 parts by weight 5 such parts of alcohol free from water.

As wine always contains carbonates, and the action of this might tend to drive the quicksilver higher, it is better to free it, therefore, from these previous to examining. To do this, we put a teaspoonful of burned and finely-pulverized lime into a small, wide-mouthed glass vial, and fill this with the wine, cork it, and shake it about a minute, then filter it through a glass funnel and filter-paper.

Carbonates.

A part of the elements of the sugar change during the act of fermentation into *carbonates.* A part of it escapes by its gaseous nature, carrying away with it from the must some part of the alcoholic fluid. Another part remains, however, dissolved in the wine, and gives it that peculiar prickling taste, and to the effervescing wines the peculiarity of foaming. The quantity of it depends on the temperature of the wine; the less this is, the more carbonate.

In the same degree as the wine afterward increases its temperature, a part of the carbonates also escape, and in this lies the reason of the turbulency of such wines (in the warmer season) as contain no more undissolved sugar. In the course of time it disappears almost entirely. The carbonatic air emanating from the fermenting must may become very injurious; in rooms where many tubs are kept, it will frequently concentrate so much that a lighted candle will not burn. Great care ought always to be taken when entering or bending over a tub. By putting fresh-made lime upon the floor of the room beneath the tubs, much harm may be prevented.

Ether.

This is a thin, very combustible fluid substance, of agreeable, penetrating smell, that forms itself in the wine by the influence of the acids upon the alcohol. Besides the "Oenanth" we find also "oxygen-ether," formed by the oxydation of a part of the alcohol, and "vinegar-ether." All these are to be charged to the account of the alcohol; and as the wine consequently thereby loses some of its strength, we ought to give the wines, at their making, so much alcohol as they would have attained if the grapes had been perfectly ripe.

Acetic Acid.

This never forms a part of the grape-juice, but invariably orig-

inates in the wine itself, if proper care is not taken to keep it out. Common policy requires, therefore, to ferment the must in *closed tubs.* It forms and increases, also, when by negligence an empty space is left in the casks between the bung-hole and the wine. This ought never to be suffered, but the casks be *filled up* every eight days.

Barrel Yeast.

This name is given to the *sediments* which are formed while the wine rests in its barrels. The question, "When, how, and how frequently shall wine be drawn off from them?" has often been raised. The best policy is to draw off the first time a few days after the main fermentation is over, and to repeat this at least two or three times before the warmer season sets in.

XII.

HUSK WINE FABRICATION.

1. *According to Cadet de Vaux.*

SAYS this eminent French savant, in his book (*The profitable Employment of different Fruits*, Paris, 1811): In order to make use of our unpressed husks of grapes for producing wine, let us make a trial:

Our crushed red grapes in the tub shall produce 15 hectolitres of wine. After the fermentation is over, we draw off 12½ litres, and leave 2½ hectolitres in the husks. These we mix with 2½ hectolitres of water of 15° R., in which we have before dissolved 25 pounds of grape sirup. We now cover the tub, and the fermentation will set in anew in about two or three hours, and cease after 36 hours. We then draw the wine off from the tub, put the husks into the press, and mix the wine out of this with the former, gaining in this manner 2½ to 3 hectolitres more, of a very fair quality and with very little cost.

2. *According to Dr. L. Gall.*

By the foregoing article we see that, fifty years ago, husk wine was made and recommended; but it was not known then that the value of medium wines mainly depended on a certain medium acid per centage; neither was it clearly understood how much alcohol is formed by a certain quantity of sugar; neither was the grape-sugar made *from starch* then known. To-day we know all this and more.

Frequent experiments have shown the following method to be practicable:

1. After the grapes are crushed and pressed, bring the press-must to that in the juice-tub.

2. Then fill the Extractor (*Fig.* 10, page 276), that is, every partition of it four fifths high, with the husks.

3. After the hoops have been tightly screwed, the must in the juice-tub must be measured, and the like quantity of water put upon the husks in the Extractor by letting it enter from below through the tube *w w*.

4. Half an hour later, pour half as much again in the same way into the Extractor.

5. After again half an hour, draw half the contents of it off, and put into it again from above, in order to wash the husks off. This operation is to be repeated a few times, and then the extract is to be drawn off into a barrel. The husks may then be pressed out, and the fluid from them mixed with the former.

6. When this is done, leaving a space free in the barrel for the sugar solution, this has to be added.

This much in respect to the husks of white grapes. If wine is, however, to be made from unpressed *red* grapes, the sugar mixture of 20 to 24 per cent. is to be added from the very start; and the young wine must be left for two or three weeks upon the husks after the main fermentation, because the coloring-matter is not dissolved before the alcohol has been formed by the sugar, and the more gets extracted the longer this remains in connection with the husks containing it.

XIII.

CARE OF WINES, AND THEIR DISEASES.

Separation of the Wine from the Matters not properly belonging to it.

We know already that the wine has two main enemies against whom it needs protection: 1. The yeast matters contained in it after the fermentation in a dissolved state, that impair its durability; and, 2. The atmospheric air. No matter how well the bungs may be closed in the casks, this latter will find ways to enter and connect itself with the former, thereby forming sediments. To guard as much as we can against these two dangers becomes our duty. *How* this may be done, Von Babo advises in the following words: If we can not avoid the yeast matters, and their efforts to combine themselves with the oxygen of the outer air, why should it, then, not be advantageous to offer to the wine, right in its youth, the oxygen that it requires for its oxydation? I think yes. Let us therefore draw it off about eight days after the main fermentation is over, by means of a perforated mouth-cover fixed to the faucet, in order to bring it into the utmost possible connection with the air.

This wine we must, however, take care to fill into a cask *not*

sulphurized (in which no sulphur has been burned), because a vigorous second fermentation is now wanted, which otherwise might be impaired. This drawing off must be repeated three or four times before the warm season sets in, viz., the second in the month of January, the third in February into slightly-sulphurized casks, and the fourth in May by means of a hose and bellows, because now the air has to be kept secluded. For this last time the casks have to be *strongly* sulphurized. After the second drawing these may be loosely bunged. The now developing carbonate protects the wine sufficiently against the entrance of air. After the third drawing the casks must be filled up to the bung, and frequently looked over, that they remain so. A fermentation-tube to the bung would prove very useful. In autumn it is advisable to apply an improvement to the wine—according to the kind of wine, either by the white of an egg, isinglass, gelatine, gum-arabic, milk, etc., etc. The two first must be dissolved two or three days previously. By adding ten to twelve ounces of salt the efficacy of each of these materials will be considerably increased. After this the wine may be refilled into a but *slightly*-sulphurized cask, eight or ten days later, by means of the hose and bellows.

Diseases of the Wine.

1. *Mould.*—One of the most common is the "mould" (*kahm*). It affects all wines except those fabricated by a mixture of the grape-juice and sugar-water. The reason for this may probably be found in the fact that the detrimental substances were partly reduced by the water already, partly extracted by the repeated drawing off during the first year. The mould forms itself upon wines if these remain in the casks for a length of time without being refilled. A thin skin is first seen, which, growing thicker, gradually appears as a fleecy scum, a sure sign of the beginning of the vinegar formation, and weakening the wine by transforming the alcohol into acid of vinegar. To counteract its progress, the cask must be refilled with wine to the bung by means of a funnel penetrating the mould skin. This flows off through the bung-hole by its being raised by the wine. Before this is done it will be well to knock repeatedly on the outside of the cask, in order to loosen the mould sticking to the inside of the staves. The inner parts of the bung-hole have then to be cleaned with a brush, and a little more wine poured in.

2. *Sliminess.*—The wine loses by this its clearness and transparency, and gets thick like oil, even in well-corked bottles. It originates from a part of dissolved vegetable glue. In very cool cellars it frequently settles of itself, without any help at all. The most efficient remedy consists in a mixture of *tannic acid*, which combines closely with the glue, and sinks it to the bottom of the cask. The seeds of grapes contain such acid, and it would, therefore, be wise always to keep a quantity gathered on hand. Six-

teen ounces of seeds of red grapes, or twenty-four ounces of white, that have not been in the fermenting tub, are sufficient for one hectolitre of wine. To extract the acid from them, pour upon these sixteen or twenty-four ounces one half litre of boiling water, and leave them therein for twenty-four hours; then rub them between the fingers to break their skin, and put all together into a clean copper kettle, which again is placed in a larger one filled with water, and heat it until the water in the latter has boiled for about two hours. All the tannic matters are then dissolved in the water, and it only needs now the filtering of the solution through linen. In applying it to the wine, mix it with two litres of this to the hectolitre; put it in small portions into the barrel, and stir the wine well up. In case the disease is merely beginning, it answers to fill the wine a few times from one cask into another by means of the funnel with a perforated covering. In all cases, the wine, after being mixed with the tannic acid, must be cleared by isinglass or gelatine, etc., etc., and after its clearing be drawn off into a sulphurized cask.

3. *Sourness.*—This consists in the progress of the transformation of the alcohol into acid of vinegar, as soon as this has been allowed to appear:

a.—*Principally*, if the casks have not been properly or not at all closed by their bungs.

b.—If they remain for a longer period in warm cellars not perfectly filled, and sulphurized, and bunged.

c.—If they are filled up with wines that already contain the poison.

In its first stage it may be kept in bounds by a mixture of honey or three or four per cent. of sugar, this producing a new fermentation, whereby the alcohol of the wine increases, and is able to resist for a time longer the inroads of the acid of vinegar. But if the wine is already perfectly sour, all remedies will be tried in vain, and it would be best to let it turn perfectly into vinegar, and sell it as such.

4. *Cloudiness.*—No matter what the cause may be, it is almost sure to yield to a properly applied melioration. But it needs to draw the wine off into another strongly-sulphurized cask, and to bring it into close combination with the sulphur as well as the remedy. To this end, burn first half only of the required sulphur in the cask, fill one third of the cloudy wine into it, add the half of the improving article (isinglass, gelatine, gum-arabic), and roll the cask about. After this, burn another one fourth of the sulphur in the empty space of the cask, put another one third of the wine in, and the other half of the clearing material, and mix all thoroughly. Finally, burn the last one fourth of the sulphur, put the balance of the wine in, whip it all well, and put the bung tight into the cask. Wines treated in this manner that do not clear off within fourteen days must be filtered.

5. *Woody and Mouldy Taste.*—These are, for the most part, testimonies of an unwarrantable negligence. A remedy we have in the following: Fill the wine over into another perfectly clean cask; add to one hectolitre of it six pounds (to one Prussian eimer about four pounds) of fresh and well-charred coals, and stir them well into it. Gradually this will settle to the bottom with the yeast yet remaining in the wine. Now take a sample and filter it through soft paper. If the taste has not abated yet, repeat the experiment, but with less charcoal. When it is found of sufficient good taste, draw it off into a sulphurized cask; clear it by means of the above-mentioned articles, and treat it as usual.

XIV.

SUPPLEMENTARY REMARKS.

Dr. Maumené says, in his work *Sur le Travail des Vins*, in regard to Pétiot's method: The results of it are clear; no enlightened man can gainsay them. Nobody will be surprised by the number of repeated fermentations, because we know that the *ferment* may dissolve enormous quantities of sugar into alcohol and oxygen. The bouquet also preserves itself better, as well as a devolution of the coloring matter takes place in such a degree as to leave hardly a difference between the results of more than one fermentation. Only the cream of tartar is reduced in those wines that may properly be called "grape-sugar wines." This reduction may, however, be rather considered as an advantage to them than detrimental, because they increase in good qualities the more the tartaric acid disappears; and for this very reason Mr. Pétiot's resemble so much the *old* wines in their agreeable and full taste.

The future of the grape-sugar wines is indeed extraordinary. This method will tend to increase immensely the products of the grape culture, prevent their scarcity in bad seasons, and benefit especially the poorer class of industrious wine-raisers.

Speaking of Dr. L. Gall's method, Mr. Von Babo says: I take it, indeed, to be the most rational. The alcohol formed from the grape-sugar affects also the taste of a wine by combining itself with free acids to ether, and connected with this, forming the aromatic flavor—the bouquet. The wine taste remains unaffected, so that such artificially-made wine could not be distinguished by it from natural ones. Remarkable results have shown that by his method, even from pure husks, containing not above 10 per cent. of juice and 90 per cent. of sugar-water, a wine is made infinitely superior to that from sour must.

Dr. Gall himself says: I only named a *tenfold* net result from the grape agriculture by a proper application of my reformed meth-

od (repeated picking out of the grapes, assorting them, etc., and "Gallizising" of the inferior balance); and Mr. Von Babo gives the proof that it may even be brought up to a twenty-fold one. . . . . In regard to the produce of the vineyard "Salem:" Here, says he, according to an average of the last fourteen years, the produce of the vintage of one morgen ($\frac{3}{4}$ acres) is $9\frac{1}{2}$ ohm, and their price 17 florins 40 kreutzers.

The average yearly income per 1 morgen, therefore, were................	167 fl. 50 kr.
The expenses per 1 morgen (excluding interest on capital invested)...	91 " 15 "
The surplus per 1 morgen consequently amounting to......................	76 fl. 35 kr.
Or, counting the stock capital at 1800 florins per morgen, and these at 4 per cent. interest...	72 " 00 "
A *net gain* resulted *per morgen* of..	4 fl. 35 kr.

Suppose now of the average yield of $9\frac{1}{2}$ ohm of wine only 5 of the most inferior quality had to be "Gallizised," and thereby their value increased by $7\frac{1}{3}$ florins, consequently raised to 25 florins; then we shall have the following calculation:

After separating 5 ohm of the inferior quality, a price of 30 florins would have been realized on an average per ohm, consequently, for $4\frac{1}{2}$ ohm..	135 fl. 00 kr.
And for 5 ohm Gallizised wine at 25 florins..................................	125 " 00 "
Total..	260 fl. 00 kr.
Deducting the expenses and interest on capital..............................	163 " 15 "
We would realize a *net gain* of each morgen of...............................	96 fl. 45 kr.

Consequently, 20 times more than by adopting the old-fashioned method.

NOTE.

1 Prussian morgen	is equal to	.63	English	acre.
1 Baden "	"	.88	"	"
1 litre (French measure)	"	.22	"	gallon.
1 hectolitre (French measure)	"	22.3	"	gallons.
1 Baden maas	"	1.50	"	litre.
1 " "	"	.33	"	gallon.
1 fuder	"	6 eimer.		
1 Prussian quart	"	.25 English gallon.		
1 ohm	"	160 Prussian quarts.		
1 hectolitre (French measure)	"	1 litre (French).		
1 Prussian thaler	"	$69\frac{3}{4}$ cents (American).		
1 " "	"	30 silber groschen.		
1 florin of Baden	"	40 cents (American).		
1 " "	"	60 kreutzers (Baden).		

APPENDIX D.

THE VINE AND ITS TREATMENT.

EXTRACTED FROM THE WORK OF FERDINAND RUBENS.

WITH ILLUSTRATIONS.

APPENDIX D.

F. RUBENS UPON THE VINE AND ITS TREATMENT.

I. The Vine and its Propagation.—II. The Vineyard.—III. Care of a Bearing Vineyard.—IV. Preserving and Shipping Grapes.—V. Diseases of the Grapevine.—VI. Choice Varieties of Grapes for Wine-making.—VII. Average Production of Wine in Europe.

I.

THE VINE AND ITS PROPAGATION.

Fig. 1.

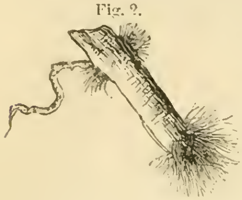
The Grape-vine (*Vitis vinifera*), on account of its climbing propensities, must be helped in the vineyards, either directly or indirectly, by training it on poles or trellises, and by pruning, etc. The roots of the vine will expand much and far. The soil should be loose. The duration or age of a vine depends much upon its well-developed trunk. The vine has shoots, which are distinguished as those which will produce fruit and those which do not produce fruit. Those which produce fruit grow out from the last year's wood; the others sprout from old wood or the trunk of the vine. Side shoots are represented in *Fig.* 1.

Propagation of the Grape-vine.

1. *Through Seed.*—This is a plan not much adopted, since the plants take from six to eight and ten years before they produce fruit. Seldom will the seed produce the same quality as the original. Through this mode, however, very choice varieties have frequently originated, which will be more identified with the local climate, and for this reason more hardy. Most of the early varieties are produced from seeds. Experiments have proved that grapes from seedlings ripen more early than the originals. The seed may be planted about two or three inches apart, and one inch deep. The seedlings will grow, by good care and on rich soil, from one and a half to two feet high during the summer. The best shoot is cut down to two buds, and the rest nicely pruned off. The following year the vines are pruned down to two buds again. From this time they are treated the same as planted cuttings.

2. *Through Buds.*—This method of propagation is excellent for choice vines which are required in quantity. Sound and strong buds are cut from vines early in spring, before the sap is in the wood. These buds contain about half an inch of wood on each side. The separate buds may be planted so, yet it is better to split the vine without injuring the bud; through this the roots are enabled to start more easily. These buds must be planted on carefully-prepared soil, or better in hot-beds, so that the bud is covered with half an inch of pulverized soil. It may be well to put a little straw, moss, or fine leaves over the soil. It must not be neglected to keep the soil moderately moist. The buds will start soon, and where otherwise leaves would start, roots will make their appearance. *Fig.* 2 represents such a bud. After a few months the buds will have started on two feet if treated with care. Such vines may grow in the first year from four to five feet shoots, and produce bearing wood.

Fig. 2.



3. *Through Cuttings.*—This mode consists in planting slips of vines. Well-matured vines with many buds are always the best, represented by *Fig.* 3. It is best to take only the lower part of a vine, and, if possible, with some of the last year's wood; then from this wood the strongest and the best roots will start. When the cuttings have been made, they may be put in bundles of twenty to thirty, and covered from two to three inches under ground. If the cuttings are made in the spring, it is best to place them in water from six to eight inches deep, and plant them when the buds have started about half an inch. If the cuttings are planted to produce rooted vines (*Fig.* 4), it is best to plant them on tolerably moist and rich land; and if the season is very dry, it is advisable to irrigate them. The finer roots of the year-old vines are more apt to grow successfully than older and stout roots of two years old.

Fig. 3.

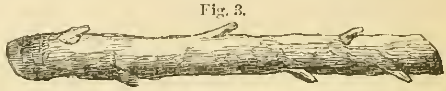


Fig. 4.

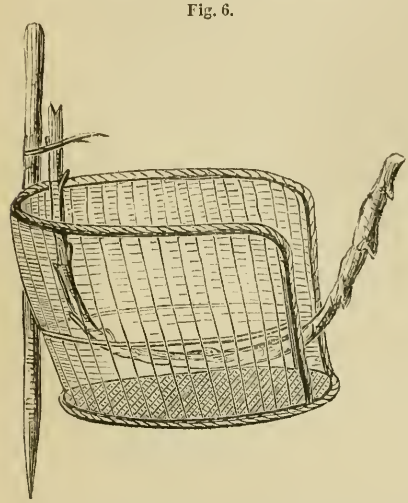
4. *Through Side-shoots or Layers.*—For this method a well-matured branch of a healthy and stout vine is taken, placed in the ground so that it will be from eight to twelve inches deep, and have two to four buds above the ground. The bend must be made gradually and carefully, so that the vine is not injured. The rooting of the

Fig 5.

vine will be promoted if the vine, where it is covered with ground, is twisted like a willow (*Fig.* 5). This layer will grow excellently during the summer, and produce an abundance of fruit.

Another plan to produce layers on every place required is attained through a method used on the Rhine (*Fig.* 6). Little baskets, of oval form, one and a half foot long, one foot high and broad, are used for this purpose. In spring this basket is placed about one foot from the old vine, deep enough to cover it. The intended layer is led through this basket, and allowed to have two buds above the ground, which are well taken care of during the summer. If it is intended to remove this layer, it is separated from the mother plant, and taken out with the basket and placed in the intended place. Rooted vines produced in such a manner are much to be preferred, as they bear fruit one year after planting.

Fig. 6.



Another method is by leading a vine through a flower-pot which is filled with rich soil. If the soil is kept moist during the summer the vine will throw out beautiful roots. In autumn, when the grapes are ripe, the vine below the flower-pot is cut from the mother vine, the pot carefully taken off, and this shoot transplanted. To promote the formation of roots, the vine may receive a cut immediately below a joint, and then be split up a couple of inches, which split may be kept open by a little wedge.

Improvement of the Grape-vine.

There are different ways of improving the vine. The grafting may be above the soil or below. To graft upon the trunk of the vine, under the soil, is the method chiefly in use in Hungary. The method is the following: The vine to be grafted is early in the spring laid bare and freed of the fine top roots. Three inches above the main roots the trunk is cut off with a saw about six

inches below the surface. The remaining trunk is split with a sharp knife from one to one and a half inches deep. To prevent the stem from splitting altogether, it is well to tie something tight above the roots (*Fig.* 7, *a*). If the vine is stout, two grafts may be taken; if not, one will answer. This graft (*Fig.* 7, *b*) must have two healthy buds above the split, and the lower bud must touch, or must be upon the trunk of the grafted vine (*Fig.* 8). If many vines are to be grafted, the following plan may be adopted: One person will lay the vine bare to a depth of six to eight inches, and clear off all fine roots to a depth of five inches; a second person will saw the vine off at a depth of four to six inches, and make the split in the trunk; a third person will place the graft and fill the hole, so that one bud is even with the surface, or barely covered with the soil. By working in such manner, several hundred old vines may be grafted during a day's work.

Fig. 7 (a).

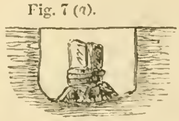
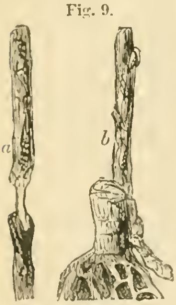


Fig. 8.

Fig. 9.



Another method is represented by *Fig.* 9, *a*, *b*. A cutting destined for the graft is taken—one with four buds; one part, between the two buds or middle, is trimmed on both sides, to present the appearance of a wedge. The trunk of the vine is cut off horizontally, then split in the centre, and on each side of this trunk a graft is placed in the split, so that two buds are above the trunk and two are below. Vines grafted in this manner succeed well.

The lower part of this graft will invariably start roots, which will favor its success. This plan may be carried out on any part of the vine above the ground, if the lower part of the graft is placed in a bottle filled with water. If it is required to graft above the ground, the following plan may be adopted: Ripe year-old wood is trimmed down and split between two joints. The graft is taken of wood of the same thickness, its end cut nicely in the shape of a wedge, and placed in the split in such a manner that the bark of both will be filled exactly, which is then bound to keep it in place.

II.

THE VINEYARD.

In laying out a vineyard particularly to be regarded are,

1. *The Location.*—In general, an exposure toward the south, sheltered from cold winds, and having a pure air, is the best place

for grape-vines. An exposure toward the north is the least favorable; toward the east considerably better, especially if western mountain ridges afford protection, or a plain exists upon which the winds may be warmed. A western exposure is yet poorer than an eastern, unless certain causes should act favorably upon it. Local considerations must be taken into account.

2. *The Soil.*—The grape-vine loves to have a loose and mellow soil, more light than heavy, not too rich, but warm. Generally a vineyard is judged by its surface soil; but the bottom soil is also of great importance, as the roots will extend largely. That is always the best which gives the least hinderance to the expansion of the roots, and, without being wet, contains sufficient moisture. A knowledge of the bottom soil is then of eminent service, if poorly-productive soil is to be improved. A greater influence upon the development of the grape-vine than the bottom soil has the surface soil, because this will come in a greater contact with the plant. The main point, if the vines are to thrive well, is that the soil should be mellow, so that the roots may expand without any hinderance to seek nourishment, and the heat penetrate easily, and no superfluous moisture will gather. For which reason, soil containing many and different ingredients will prove the most beneficial for vines; as, for instance, decomposed granite, lava, etc., upon which the vines will thrive beautifully, and are not liable to the different diseases. Silicious and calcareous earths, if predominant, are best adapted for grape culture, especially if mixed with some clay. If these ingredients are entirely deficient in the soil, they may be supplied by manure. If clay is predominant, the soil will be heavy and binding; will retard the expansion of roots, and will receive the water tolerably easy, but will be long moist, through which the soil will get cold. To improve such land artificially would prove too expensive.

3. *Selection of Vines.*—This is often very difficult, as not only the locality and soil has to be regarded, but the nature of the vine and the quality of the product raised must be taken into consideration. The following may serve for a guide:

In districts of hot and southern exposure, the white Riesling commands the first place, which combines all qualities to produce a first class wine.

Should the soil be too rich in such location, and the Riesling, through a rank growth, impair the quality of its product, the red Traminer (*Auvernas rouge clair*) may be taken, which will produce a first class article. In the same category comes the spice Traminer. This variety is, in regard of locality, more easily affected, and will invariably require a warm and sheltered place. For a second class location as regards soil and place, and commanding attention for their early ripening and the quantity of the produce, the Rulander (*Gris commun*), the black Clavner (*Morillon noir*), and Sylvaner, are recommendable. The Rulander will produce a

sweet, pleasant, spirituous wine. This variety will thrive best upon low, level, and a little moist soil.

The black Clavner (*Morillon noir*) will thrive best upon clayish soil, if this is loose and not too moist. This plant is very hardy, and produces much fruit. The Clavner is chiefly used for the manufacture of red wines; but much white wine is also made of it, which will distinguish itself through its pleasant and beautiful bouquet. Sparkling wines are mostly made from the must of these grapes.

The Sylvaner is satisfied with a less favorable location, and even a colder place and poorer soil than the Clavner. In districts where only a poorer quality of wine is produced may be recommended the *Chasselas blanc* and the *Chasselas croquant.* They require a heavy and moist soil; in sandy land, if it is well manured, they will thrive very well. The wine is mild and pleasant, and will be so in a poor season, as these varieties contain but little acid. The vines are lasting, and produce well every year.

The green Sylvaner likes a dry and loose soil; will thrive excellently in the poorest soil.

The Ortlieber is a plant which will produce an immense quantity of fruit, and in a poor locality will give a sweet and pleasant wine. It is satisfied with the poorest soil.

The early Burgundy, blue or black Burgundy: In a good season this variety, in a poor location, will produce a wine which can be placed side by side with the finest red wine on the Rhine.

In what proportion these different varieties should be planted can not be exactly determined, as this depends much upon local circumstances, of the location, the soil, the required quality and quantity of the product required. For hot, hilly, and dry locations, the following proportion may be taken as a basis: $\frac{1}{3}$ Riesling, $\frac{1}{3}$ red Traminer, and $\frac{1}{3}$ green Sylvaner; or, $\frac{1}{2}$ Riesling, $\frac{1}{3}$ red Traminer, and $\frac{1}{6}$ black Clavner; or, $\frac{1}{3}$ Riesling, $\frac{1}{3}$ Welshriesling, $\frac{1}{6}$ spice Traminer, and $\frac{1}{6}$ red Traminer. For hills which are dry and not so hot, which have richer soil and a more eastern or western exposure, may be taken, $\frac{1}{3}$ Riesling, $\frac{1}{3}$ green Sylvaner, $\frac{1}{6}$ red Traminer, and $\frac{1}{6}$ black Clavner; or, $\frac{1}{3}$ Riesling, $\frac{1}{3}$ Sylvaner, $\frac{1}{6}$ spice Traminer, and $\frac{1}{6}$ black Clavner. For a location more hilly, cool and rich soil: $\frac{1}{3}$ black Clavner, $\frac{1}{6}$ Rulander, $\frac{1}{6}$ red Traminer, $\frac{1}{6}$ green Sylvaner, and $\frac{1}{6}$ Chasselas blanc; or, $\frac{1}{3}$ red Traminer, $\frac{1}{3}$ Chasselas blanc, $\frac{1}{6}$ green Sylvaner, and $\frac{1}{6}$ black Clavner or early Burgundy. For a cold place and good soil: $\frac{1}{3}$ early Burgundy, $\frac{1}{3}$ green Sylvaner, $\frac{1}{6}$ red Traminer, and $\frac{1}{6}$ Ortlieber. For quite cold places and dry soil: $\frac{1}{3}$ green Sylvaner, $\frac{1}{6}$ blue Arbst, and $\frac{1}{6}$ Ortlieber or early Burgundy. In the distribution of these different varieties, the peculiarities of the separate kinds must be taken into consideration, so that each may receive a place most adapted to its propensities.

Laying out new Vineyards.

Preparing of the Soil.—In laying out new vineyards two points are particularly to be considered: whether the piece of land has never been planted with grape-vines, or whether it is an old vineyard which has to be planted anew. In the first case the following things should be taken into consideration:

1. *Turning of the Soil.*—As the grape-vine requires the soil very mellow, this is attained by turning the soil from two to three or four feet deep. Of the most advantage is it if it can be done after the grape-gathering, and remain then in that state until spring. The manner in which this is done is not material, only the best mode is to have it done by hand and with the spade. To subsoil the land with plow will answer nearly the same purpose, should hand-labor be too expensive. Should the soil be hard, and not allow the water to run off easy, the land should be ditched. Is an old vineyard intended to be planted anew, it is decidedly the best to rest the land for a few years, to gain certain substances which have been exhausted by the vines, unless the bottom soil should be decomposed rock. In this case the turning of the land will answer. If this is not the case, the land should rest for at least three years. Grass or clover may be sown on the same. In the third year the grass must be turned under to decay.

2. *Terracing the Ground.*—Terraces are made on steep hill-sides, to form them into so many pieces of land with a level surface; firstly, to be able to cultivate the vines more easily; and, secondly, to retain the moisture as much as possible. Stone walls are built to form the terraces, which are inclined toward the hill, to be able to resist the pressure of the earth.

Division of a Vineyard.

What distance to plant the grape-vines from each other depends more or less upon the slope of the land, the variety of grape-vine, the soil, and the method of training the vines. In vineyards where the land is of a gradual inclination, the vines should be planted farther apart than on land which is steep; on level land or plains, farther apart than on hill-sides; vines of rank growth, farther apart than those which grow but little wood; in strong and rich soil, farther than in poorer soil; vines trained on trellis, farther than those trained after the common vineyard style.

The vines and the rows must be so far from each other that the sun can penetrate to the foot of the full-grown vines, and the air be able to strike freely between the rows, so that the grapes may attain their full ripeness.

Planting a Vineyard.

The spring is the best time for planting, if the soil is very rich and heavy. In regard to the selection of vines, the necessary

points have been mentioned. The best adapted are year-old rooted vines, then follow cuttings. When rooted vines are planted, all the fine roots toward the top of the vine should be trimmed off, the remainder trimmed to about four or six inches in length. In regard to the age required for rooted vines, opinions differ much. Some prefer three and four year old; but it is generally conceded that the finer roots of year-old vines are more apt to be successful. It is well to mark the place of each planted vine with a little stick, to prevent it from being covered when the ground is again cultivated.

Treatment of young Vines.

The main care and object are to have the vine form a strong and healthy head. It has been proved that the stouter and more healthy the head of a vine is, the more durable and fruitful are the vines.

To form this head of a vine, the young shoot should be entirely cut off, or close off to the old wood. By this process the dormant buds will start, which produce beautiful strong shoots. During the summer the ground is kept clean and loose, to promote the growth of the young plants. If these vines grow more than two or three shoots, the others are broken off. It is better not to tie these young shoots, as they will grow stouter when exposed to the wind. The third spring the vines are pruned down to one or two buds, according to their strength. During the summer the ground is kept clean.

The fourth spring, the vines should be allowed to have about four shoots, each of four buds; a uniformity should be looked to, the branches should spread, and, if possible, be of equal height.

In poorer soil, the forming of a head on a vine is attended with more difficulty.

Methods of Training and Pruning Vines.

The different methods of training vines may be divided into three classes: 1. Without any props, or free. 2. Trained on props. 3. On trellises.

In the first class come all grape varieties which are trained low on the ground, and such as require this system, as Riesling, red Traminer, etc. In the second class, in rich soil, the same varieties, the black Clavner, Rulander, etc. In the third class, varieties which grow considerable wood, and require to be pruned long; as a few sorts of the Chasselas, Trollinger, and others.

For vineyard purposes those methods are best in which the grapes are brought as near the ground as possible. The more this is the case, the more early will the blooming set in, as well as the ripening of the grapes; and wine produced from such grapes will be heavy and spirituous. The ripening of the grapes depends not so much upon the direct action of the sun as upon the

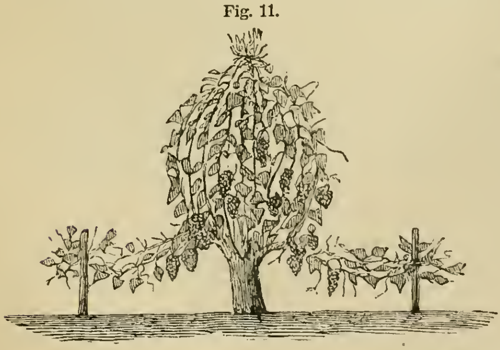
heat which the soil throws out; for which reason, grapes in the immediate neighborhood of the ground, and covered entirely by vine-leaves, are often the ripest. Excellent pruning methods to accomplish this are the following:

1. *The Head-pruning.*—This will form the lowest training of the vines. The pruning is very simple, as all shoots with year-old wood are pruned off; and of the new vines, according to the strength of the grape-vine, from four to ten are left, which are pruned so that each shoot has one bud left. After the blooming is over, the young shoots may be brought upward and tied together (*Figure* 10). It will represent almost a balloon form. To prevent the shoots from bending down under their own weight, the end should be cut off over the place where they are tied. The grapes will hang in the shape of a wreath around the vine, and can have all the influence of air, light, and sun, through which they not only ripen more early, but they gain in sweetness and produce an excellent wine. For level slopes, and for places of a light, warm soil, and a sheltered, dry location, this method is to be preferred to any other. In districts where wood is scarce or expensive, this plan should be followed.

Fig. 10.

2. *The Bush-pruning.*—This method differs from the foregoing only in that a few of the last year's shoots are kept on the vine, which are pruned down to 2 or 3 buds (*Figure* 11). Should the number of young shoots amount to 12 or 14, they are divided; some are tied together over the vine balloon-fashion, while others are, as represented in *Figure* 11, tied together with shoots of a neighboring vine, which is supported with a little pole. This method is adapted for richer soil and hot localities.

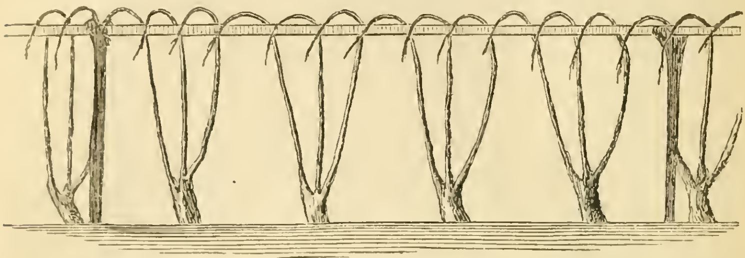
Fig. 11.



3. The method of the *Landerbach pruning* is best adapted for steep hills with rich soil, as the vine will be supported by a prop. The young vines are not tied balloon-like, as by the foregoing method; they are spread like a fan, and give the same result and advantages as the plans No. 1 and 2, exclusive of the cost of the props. The grape-vine has generally two or three branches

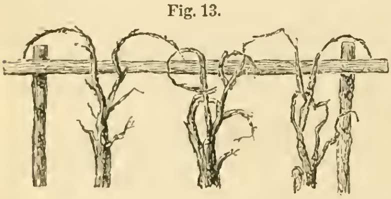
one half to one foot long, on which young shoots have been pruned down to two buds. The young shoots grown during the summer are tied with their ends on the prop. Before tying them permanently they are bent down, to prevent them from being in a close cluster, and to give free access to the air.

Fig. 12.



4. Another method of training vines is to grow three branches on the trunk of the vine, and to allow the same to lean over bars supported by posts (*Figs.* 12, 13). The bar is about two and a half feet from the ground. All the side shoots of the branches growing upward are carefully pruned off. The incline of the branches lying over the bar is toward the south. The grapes and the growth of wood will lean to the ground, showing that the grapes derive benefit from the heat of the soil. The distance of the rows is six feet, and the distance of the vines four feet. The young will grow during the summer upward, but gradually, through their own weight, lean down. By adopting this plan a great quantity of props may be saved.

Fig. 13.

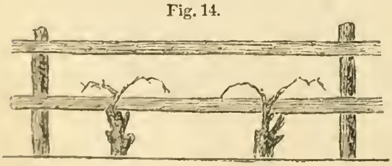


Training the Vines on a Trellis.

According to the distance from the ground, this method is divided into the low training and the high training on a trellis.

The plan of *low training* (*Fig.* 14) is very judicious for varieties which require short pruning and the low system of training. This mode requires but little wood; it is a supporter to all the young shoots, and affords to the vines all the advantages of light, sun, and air. It is exceedingly well adapted for hills with dry soil. The height of the frame is between one and two feet.

Fig. 14.



The high mode of training differs from the other only in this, that the frame is from two to three feet high. This mode is the

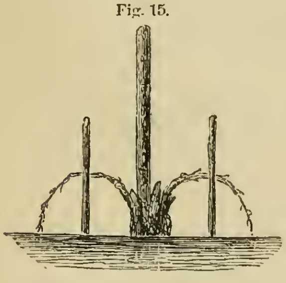
most in use, as it will afford more room, and is best adapted for vines which grow much wood.

Training of Vines with low Boughs and Layers.

This mode is excellent, as it can be introduced into any vineyard without any preparatory work. Grape-vines treated after this mode produce not only more and better grapes, but, at the same time, young rooted vines, which might serve for planting of new ground. The method is plain, and the following will illustrate it: After the gathering of grapes, the vines are pruned in such manner that the two finest branches are exempted and selected for layers; the rest of the good and bearing branches are pruned down to two buds. The two branches are bent down in a half circle, and the ends of the same are placed from six to eight inches deep in the ground. It is well to have one layer toward the west and the other toward the east, to give them all possible influence of the noon sun. During the next spring these layers will grow beautiful roots, and are able to support part of the grapes on this layer.

The grapes grown on these layers will distinguish themselves through their quality and size, which can be easily accounted for, as they receive nourishment from two sources—first from the old vines, and secondly from the roots of the layer.

Fig. 15.



After the gathering of grapes, the layers are cut off close from the old wood of the vine, and may then be taken out of the ground and replanted, or remain on the place to be substituted for old vines or vacant places. The other shoots are treated in the same manner as mentioned before. *Fig.* 15 will serve for an illustration.

III.

CARE OF A BEARING VINEYARD.

YOUNG vineyards may, in the first two or three years, be used for raising vegetables, but it must not be neglected to keep each vine free from influence of weeds. In old vineyards nothing is to be allowed to grow besides vines. Even the turning rows should be kept free of weeds and grass. Fruit-trees are very injurious to the vines, as they will stint them of nourishment, sun, air, and light, and so retard the development of the grapes.

Pruning of the Vines.

The pruning of the grape-vine is the most important part of its entire management and culture. It demands knowledge, care, and experience. The aim of the pruning should be the forming of wood for the coming year, and the forming of fruit in the present. This law of Nature must be especially regarded, that the grape-vine produces its fruit always on healthy shoots of the year previous; for which reason, all vines which have produced fruit are pruned off, and have to make room for young shoots grown during the summer.

If the grape-vine is not pruned, it will form a mere bush, of which the weak shoots will not derive any benefit from the influence of the sun, and will produce only small, sour grapes, which ripen late. For this reason, all shoots are pruned off which are not required for the forming of fruit or reserve wood for the coming season. A main object should be, that the vine shall produce as much fruit as possible without injury to it in the future. Varieties which grow much in wood, as, for instance, the Muscatel or Trollinger, and others, must not be pruned as short as the Riesling and Traminer. If the soil is rich, and the locality good, the

Fig. 16.

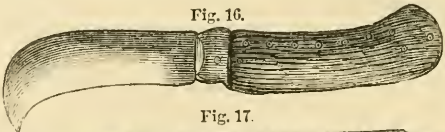


Fig. 17.

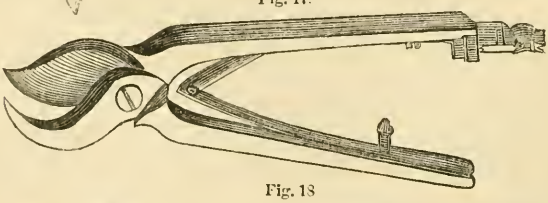


Fig. 18

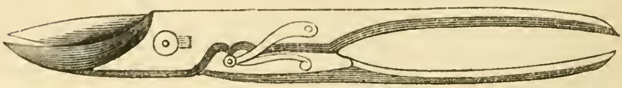


Fig. 19.

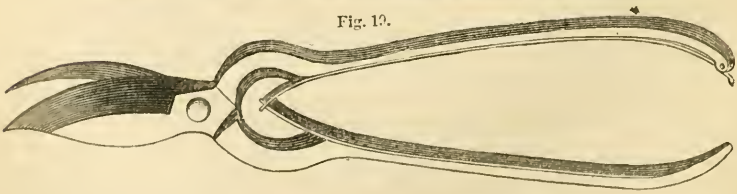
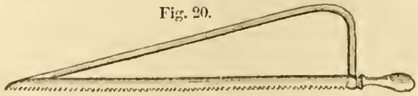


Fig. 20.



vine may have proportionally more wood than in light and hot soil.

It must be observed that the cut is not so close to a bud as to prevent the drying out of the wood. *Fig.* 16 represents a pruning-knife; *Figs.* 17, 18, and 19, shears which are successfully used. For trimming of old and dead wood a little saw should be used, *Fig.* 20.

The time when the pruning should take place depends much upon the vine itself, partly upon climate and soil. The pruning of the vines after grape-gathering is in many places customary. In warm climates, where grape-vines will not suffer from frost, the pruning in autumn is certainly preferable.

Propping the Vines.

This work should commence immediately after pruning. The props should be placed from four to six inches from the vines, in order not to injure the roots. As the wood of the vines is most tough after a rain, it should be tied then. If vines are pruned in autumn, this work is suspended until spring.

The first Cultivation of the Soil.

The first cultivation should begin in the spring, when the weeds have made their appearance. The intention of this work is to loosen the soil, in order that the heat and air may penetrate it. The depth of cultivation depends upon the state of the roots. If they are deep, it is better to cultivate from eight to nine inches deep than only from five to six. The turning of the surface is very beneficial, and at the same time will cause the extermination of weeds.

Spring Pruning.

The time of this work depends upon the development of the young shoots. For instance, if they are about four inches long, it certainly must be done before the blooming commences. It should always be done during dry weather. All young shoots which bear no fruit, or are not destined for the next season, are broke out. To break off the side shoots is injurious to the vine, as well as to the development of the grapes.

Ringing the Vines.

Fig. 21.

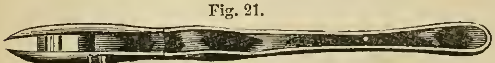
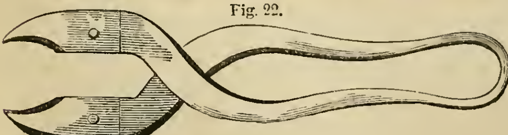


Fig. 22.



This is done similar as with fruit-trees. It consists in this point, that the bark of a grape-vine is cut around twice, nearly one quarter of an inch apart, without in-

juring the wood. The bark between these two cuts is carefully taken out. For the forming of these cuts a certain kind of shears are used, represented by *Figs.* 21 and 22. This work is done about six or eight days before the blooming, and always on old wood, below a young shoot.

The second Cultivation of the Soil.

The turning of the soil should not be very deep, as it is the main object to kill the weeds.

The last Cultivation of the Soil.

This should be done when the grapes begin to get soft, to improve the action of the soil. Even upon the poorest and driest soil this work will be beneficial.

The Gathering.

Fig. 23.

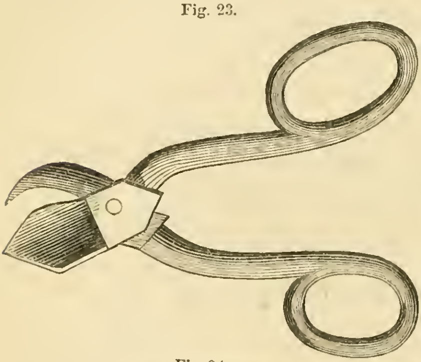
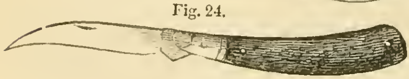


Fig. 24.



The time of gathering depends upon different circumstances: the season, the variety of grape-vine, etc. It is of most consequence to have varieties planted which may ripen at the same time. Again, the different varieties should be gathered by themselves. In a poor season, it is essential to commence gathering after the dew is dried off. *Fig.* 23 represents a shears, and *Fig.* 24 a knife for taking off the grapes.

Manuring.

The principal varieties of manure are,

1. *Animal Manures.*—These consist of meat, blood, hair, wool, feathers, bones, rags, leather, etc. All these substances cause not only the dissolution of the humus, but through their animating power they heighten the vegetation. In applying these manures to the soil they should be in small particles.

2. *Vegetable Manures.*—These consist of decomposed substances of the vegetable kingdom. Weeds and grasses belong to this class. They have not the same effect as animal manure. In rich soil they are to be preferred to any other, as through them the soil will be freshened and cooled. An easy mode of manuring is to sow lupines between the rows, and after they reach the height of a foot, to spade them under ground. In poorer vineyards grass

may be sown, especially in clayish, heavy, and little moist soil; through it the qualities will enhance much.

3. *Vegetable-animal Manures.*—These consist of excrements of animals. This manure will not act as soon as animal manure; it decomposes sooner than vegetable, and is for this reason animating. It promotes not only the activity of the soil, but it will act upon the decomposition of the humus. The quality will depend upon the fodder of the animals, and the care bestowed upon the manure. The best manure for grape-vines is always that from cattle. Horse and sheep manure may be used with advantage. For hot soil, manure from cattle is to be preferred; for cold and moist soil, that from horses and fowls may be used.

4. *Mineral Manures.*—The best is lime. Marl is excellent manure, especially if it contains lime. Sand is the best improvement for heavy soils.

IV.

PRESERVING AND SHIPPING GRAPES.

Quality of the Fruit.—Grapes which were grown during a warm and dry year, or on a warm and dry soil, will keep longer than those which have grown in a cold and wet year. Thickly-clustered grapes, of a thin skin, and which contain much watery substance, are always inclined to decay soon, which makes them unfit for preserving.

Selection of Varieties of Grapes.—Only those grapes of which the berries hang loose and have a thick skin should be selected for packing. The different varieties of Chasselas are well adapted for this purpose, especially the *Chasselas de Fontainebleau*, *Chasselas blanc*, and *Chasselas croquant.* The grapes should remain as long as possible on the vines. A little frost will not hurt them.

Different Ways of Preserving Grapes.—(1.) To preserve single bunches of grapes, they may be laid on a board, then covered with flower-pots, glass bells, etc., and the hole be covered with fine sand. (2.) The grapes may be placed in a cellar, and suspended on frames without touching each other. The grapes should be looked after every week to separate the bad berries. It is well to ventilate the place in which they are kept occasionally. (3.) Clean barrels may be used, one head be taken out, and the grapes packed in the barrel with fine sawdust; after which the head is put on again, and the barrel then placed in a dry cellar of even temperature.

The principal object should be to pack the grapes in as dry a state as possible. If the distance is not far, the grapes may be packed carefully in boxes, and then covered. Otherwise they should be packed in sawdust, and then covered with a lid.

V.

DISEASES OF THE GRAPE-VINE.

1. *The Jaundice.*—This disease may be recognized by the leaves turning yellow on the short shoots, and loose grape bunches with small undeveloped berries. It is caused by an unfavorable wet season, very deep or low location, often through a general weak vegetation of the vines, through age or insufficient nourishment in the soil; and it will affect vines which are not suited for the soil. If insufficient nourishment is contained in the soil, it should be helped by applying suitable manure. In moist soils drains should be constructed. If acids in the soil cause this disease, the mixing of ashes with manure will be of service.

2. *Consumption, or Wasting Away.*—This disease is the cause of a continual state of jaundice. The only remedy is to apply suitable manure, a good cultivation of the soil, draining of the land, and separating the injurious substances of the soil, as, for instance, saltpetre. Decomposed manure should be used.

3. *Mildew; Blight.*—When rainy weather alternates with very hot, vines are apt to be affected by this sickness. It commences around the rim of the leaves, and increases canker-like, until the leaves, the stems, and the ends of the young shoots are affected by it. This disease will often stop of itself; otherwise there is no cure for it. To trim off the ends of the shoots, and cover the ground with hay or leaves, is said to prevent this malady.

4. *The Black Mortification.*—The black Clavner is principally affected by this disease. It may be distinguished by black spots on the under side of the leaves, which increase in number until the leaf is covered by them. The leaves will gradually die and fall off, through which the development of the grapes is retarded, especially if the vines are attacked by this sickness early. In valleys in which the heat is doubled through the reflection of the rays of the sun, and exposed to cool nights and moist fogs, this sickness is often quite a plague. Against this evil there is no remedy. It may be retarded by planting hardy varieties in such places, the summer pruning of shoots with fruit, and by checking the too rapid vegetation, and by planting the vines far apart, to allow the soil the greatest influence of the sun.

5. *The Dropsy.*—The grape-vine affected thus will produce much wood and leaves, but only sparely grapes, which will not attain ripeness. It is caused by the roots penetrating deep into moist and cold soil. It will be checked if the land is drained, some of the larger roots cut off, and around the roots a quantity of sand and gravel is placed.

6. *The Cancer.*—This will happen chiefly to three and four year old vines on rich and heavy soil, during a rapid change of cold

and wet weather, which cause the bark of the vines to burst. As a remedy, it is advised to heap the soil on the vines in autumn, and to leave it in spring until there is no more danger of cold and wet weather.

7. *Excess of Sap.*—If it is noticed early in the season that the sap will merely form wood, pruning will help much, or ripping the bark off the vines to allow the outflow of surplus sap.

8. *The Sour Rot.*—This disease will make its appearance after long and cold rains, which cause the undeveloped grapes to rot. If the weather does not improve, the entire grape-crop is lost. Such sour grapes are to be carefully separated from grapes for wine manufacture, as these grapes will impart to the wine a very unpleasant taste.

9. *The Grape-sickness, Oïdium.*—This terrible disease has within a few years made its appearance in all parts of Europe. The sickness affects the leaves, the young shoots, and the grapes. It appears in a variety of fungus, termed *Oïdium Tuckeri*, hardly perceptible at first with the naked eye, presenting a whitish cover, which will gradually form a connected crust. During a more developed state of this sickness, the entire vines are covered so much that at a distance of twenty steps it may be perceived. If the grapes are affected by this sickness early, they will remain hard and unpalatable, and seem to be incompetent to develop farther. As a remedy, flour of sulphur is used, which, after many experiments, has proved the best, especially during the first stage of the sickness. Road-dust used in the same manner as sulphur is said to act well. A remedy is said to be successfully applied in the Tyrol: it is, two pounds of gelatine dissolved in one pail of water, in which the grape bunches are dipped when of the size of duck-shot.

VI.

CHOICE VARIETIES OF GRAPES FOR WINE-MAKING.

Grapes from which the finest White Wines are made.

1. White Riesling, Riesling, spice Traminer, etc., Una pusilla, etc. The grape-vine is small, the wood is thin, the grape bunch is small, thick at times, a little loose, plain, often with branches, and short stem. The berry is fleshy, with a thin skin, often a little flat, of aromatic, pleasant, sweet taste, with two kernels. The Riesling is in Germany the king of all grape varieties. It demands a first class location, shelter against cold winds, rather heavy than light soil, and requires to be trained low.

2. White Welshriesling (*Meislier de Champagne*). The grape-vine is small, the wood thin and short; the berry yellowish green,

sweet, aromatic, with a fine skin. The grapes produce a very durable, heavy-bodied wine, but it has not that beautiful bouquet of the Riesling. This variety ripens late, and requires an excellent warm place, thrives well in poorer soil, and must be trained low.

3. Red Traminer, Auvernat rouge clair, Gris rouge, Formenteau. The vine is small, the grape-bunch small, close, with shoulders and short stems; the berry gray-reddish, thick skin, juicy, very fine flavored. These grapes produce an excellent, pleasant, sweet, fiery, and durable wine. The grape will preserve well, and for the table a choice article. The Traminer demands a sheltered location.

4. The spiced Traminer may be called a cousin of the red Traminer, which is distinguished through its aromatic taste.

5. Orleans (Raison et Orléans). The vine is large, the wood is long, the berry oval, hard, fleshy, with a thick skin, whitish-yellow, of a fine taste. This vine will produce as much again as the Riesling. The wine requires some time before it attains maturity. Mixed with Riesling the wine is elegant. As a table grape it is to be recommended. It requires a hot, deep, stony soil, and a hot place on a hill-side.

6. Rulander, Gris commun. The vine is of middle size, often small; the grape-bunch is of middle size; the berries oval, often round, brownish color, very tender. This variety ripens more early than any above mentioned. The wine is exceedingly fine, and is used for the manufacture of Champagne. The vine will thrive almost in any soil, and produce much fruit if manured. It is well adapted for covering of low trellises.

7. Black Clavner or Black Burgundy, Chiovenna, Morillon noir, Pineau, Auvernat, etc. The vine is middling large, wood is tolerably long, thin, reddish-brown; the ends are a little woolly. The grape is small, closely clustered. The berry is oval, often round, dark blue, with a thin skin, and of a pleasant, sweet taste. Of this excellent variety are the finest red wines made in Germany, for instance, Assmannshausen, Ingelheim, Aarbleichert, etc.

8. Blue Arbst, Pineau, Auvernat, is a variety of the former. First class wines are made in Baden from this vine. In regard of culture, growth, and use, it is the same as the Black Clavner.

Grapes which produce a Middling, mostly light White Wine.

9. Chasselas blanc or verd. The vine-growth healthy and long shoots. The grape is loose, of a long form; the grape-stem is long, thin, and red; the berries are round, greenish-yellow, with a thin skin, transparent, and covered with fine dots. The flesh is mellow, juicy, and of a sweet, aromatic taste. This grape will produce much, but only a light, mild wine, which is poor in alcohol. As a table grape it commands the first place.

10. Chasselas croquant. The wine of this variety is of a better quality than of the Chasselas blanc. The grape-vine requires

a rich soil and a very sunny place. As a table grape it is much liked on account of its sweet and hard flesh.

11. Sylvaner. The vine is of middle size, the wood is short, light brown, which is striped and spotted. The grape-bunch is middling large, short, very thick. The berries are round, oval, yellowish-green, spotted, and have only one kernel. The flesh is tender, green, juicy, of an excellent, pleasant, peculiar sugar taste, which enhances its value as a table grape. The wine is very mild, seldom quite clear, and requires to be consumed very soon.

12. Morillon blanc, Bourguignon blanc, etc. The vine is of middle size and growth, tolerably long wood. The berry is very juicy and sweet. It produces a tolerably good wine of middling quality; will thrive almost in every locality and soil.

Grapes of which first-class Red Wines are made.

No. 7 Black Clavner commands the first place.

13. Raisin précoce. Morillon hâtif produces an elegant red wine at Karlstadt. The grape-vine is small, requires a good location, and to be trained low.

14. The early Magyars is in Southern Germany planted, and gives a beautiful wine. The berries are very sweet and tender.

15. Français noir, Liverdon, Plant St. Martin. The vine is middling large; the wood is thin; the berry dark blue, very juicy, sweet, and pleasant. This sort is to be recommended for vineyard purposes. It requires a sheltered place.

Grapes which produce a tolerably good Red Wine.

16. Blue Raushling. The vine is small, the wood is short. It belongs to the better table and vineyard varieties. If the grapes are pressed immediately, a tolerably good white wine can be made of them. The vine produces considerable fruit; is suited with every location, soil, and the different modes of training.

17. Meumer, Façonne, Morillon tasconi. Has its name from the appearance of the leaves, which especially look, early in the season, as if they were covered with flour. The grape-vine is middling large, the wood is long. The grape is tolerably large and thick; the berry is blue, red-fleshy, juicy, and tolerably sweet. It demands a rich, light soil.

VII.

AVERAGE PRODUCTION OF WINE IN EUROPE.

Germany produces in	Eimer of Wine	upon	Morgen of Vineyard.
Saxony	20,000	"	10,000
Prussia	425,000	"	90,000
Bavaria	1,200,000	"	210,000
Wirtemberg	600,000	"	110,000
Baden	420,000	"	110,000
Other States	400,000	"	58,000
	3,070,000	"	588,000
The Austrian Empire	42,000,000	"	4,500,000
Greece	70,000	"	480,000
Archipelago of Greece	60,000	"	72,000
Italy	75,000,000	"	4,800,000
Switzerland	150,000	"	128,000
France	52,000,000	"	8,400,000
Spain	8,500,000	"	1,600,000
Portugal	1,500,000	"	400,000
	182,350,000	"	20,968,000

This number of eimers make about 15,500,000,000 bottles of wine of all varieties and quality.

APPENDIX E.

THE MANUFACTURE OF SPARKLING WINES.

EXTRACTED FROM THE WORK OF J. BEYRE.

WITH ILLUSTRATIONS.

APPENDIX E.

J. BEYRE ON THE MANUFACTURE OF SPARKLING WINES.

How the Sparkling is produced.—How to regulate the Sparkling.—The Œnometer. — Manufacture of Sparkling Wine. — Double Faucet. — The Bottles.—Caillet's Cleaning Apparatus.—The Corks.—Leroy's Corking Machine.—Maurice's Corking Machine.—Fastening the Strings.—Fastening the Wire.—Piling the Bottles. —Storing the Wine.—The Aphrometer.—Placing Bottles.—Removal of Sediment. —Boiled Liquors for the English Market.—Cold Liquors for the English Market. — Mosbach's Funnel. — Cameaux's Charging Machine. — Machet Vacquant's Charging Machine.—The Liquor.—Filtering the Liquor.—Sealing Mixtures.— Jaunay and Maumené's Improvements in the Manufacture of Sparkling Wines.— Generating Carbonic Acid.—Adulteration of Wines.—Explanations of Plates.

How the Sparkling is produced.

The difference between sparkling and common wine consists in the large quantity of carbonic acid contained in the former, which, by putting the wine in casks before the vinous fermentation is completed, and closing them tight, is thus prevented from escaping. The fermentation proceeds in the bottles, and the carbonic acid which is thus developed mixes with the atmospheric air in the chamber of the bottle, and by its pressure on the wine causes the gas to impregnate the same, which afterward, at the uncorking of the bottle, rises to the surface by its expansive force, causing an explosion, and producing the sparkling and bubbling.

As all wines contain carbonic acid, any wine can be made sparkling; but strong and sweet wines, and even such as are somewhat astringent, absorb a larger quantity of this gas than dry and sweet wines. None, however, is better adapted to produce a sparkling wine than that grown in the Champagne district; hence most sparkling wines are called *Champagne.* Moselle, Rhine, Neckar, and some light Hungarian wines are also well adapted for the purpose.

The pressure which the gas exercises in the bottles amounts to four, five, and even six atmospheres, but infallibly bursts the bottles when it attains the height of seven or eight atmospheres.

As to the sparkling capacity of the wine, it is generally the case that the kind of wine which explodes loudest sparkles but little when standing in the glasses; whereas, on the other hand, the wine which sparkles briskly and lively explodes but with a weak sound. This depends on the capacity of the wine to absorb more or less carbonic acid, for the less it absorbs the more gas gathers in the chamber of the bottle, and the more it must be compressed, and consequently the explosion must be stronger and the cork be

driven to a greater distance. By this it is apparent that the wine must be of such a quality that a correct relation exists between the gas condensed in the chamber and that absorbed in the wine.

At the opening of the bottle hardly one third of the gas escapes. If the same were kept in the wine by pressure only, it would naturally escape entirely on the removal of the cork but for the adhesive character of the wine, which is strong enough to require a certain mechanical influence to liberate the carbonic acid thus absorbed. Also will a piece of sugar, a crumb of bread, or a raisin thrown into the wine after it has been poured out, cause a new agitation and produce a lively sparkling.

The temperature the wine is kept in is of no less importance, for the higher it is the easier the carbonic acid develops itself. Champagne that has been placed in ice for a considerable time will therefore not foam at all.

How to regulate the Sparkling.

It was not till 1836 that H. François, of Châlons sur Marne, published a rational method to regulate the sparkling. Maumené, in his book on Champagne, for instance, gives us the following items, which go to show how little profit the early manufacture of that wine rendered:

"In the year 1746 I bottled 6000 bottles of a wine of very heavy body: 120 bottles were all that remained of this lot; all the others burst. In 1747 the wine did not contain quite so much liquor as the preceding season, but still one third of the bottles exploded. In 1748 only one sixth of the bottles burst. In 1749, the wine being more astringent, I lost only one tenth; and in 1750, when the wine of Jacquelet was still more so, I lost not more than one twentieth of my Champagne by the bursting of the bottles."

The method of Mr. François, above referred to, consists in the following *new* manner of using the Œnometer, invented by Mr. Cadet de Vaux, and perfected by Engineer Chevalier:

A bottle of wine is, by boiling it down, reduced to four ounces, by which process the alcohol is set free, and only the sugar and several salts remain. After the crystallization of the tartaric acid has taken place, which generally occurs in 24 hours, the degree which the Œnometer indicates must be marked. Now when the liquid thus condensed shows not more than 5° above zero, the wine will not sparkle in the bottles, not even at 20° and 25° C. These five degrees represent the specific gravity which the sugar and saline particles give to the wine.

Eight days before the wine is bottled, sugar or liquor of wine (one pound of candied sugar to each bottle of wine produces this liquor) are added, according to the following table:

At 5° below 0,	7 lbs.	sugar	or	7 bottles	liquor	of wine.		
6°	"	6	"	"	6	"	"	"
7°	"	5	"	"	5	"	"	"
8°	"	4	"	"	4	"	"	"
9°	"	3	"	"	3	"	"	"
10°	"	2	"	"	2	"	"	"
11°	"	1	"	"	1	"	"	"
12°	"	0	"	"	0	"	"	"

This table is founded on the following observations of Mr. François:

1 bottle	containing	1	quentchen (gros)	of	sugar	shows only very weak sparkling.
"	"	2	"	"	"	tolerable sparkling.
"	"	3	"	"	"	complete sparkling: the foam escapes the bottle.
"	"	4	"	"	"	the foam escapes as a stream.
"	"	5	"	"	"	sparkling with great vehemence.
"	"	6	"	"	"	extraordinary vehemence of sparkling.

Nearly all bottles which contained six gros (1 gros=72 gram.) burst, and those containing five gros are also apt to burst.

According to these observations, the wine requires an addition of 4 gros sugar per bottle, or 900 gros (a little over 7 lbs.—7.03) per cask of 225 bottles. Consequently, when wine that has been boiled down as above mentioned shows, on measuring it with the Œnometer, only 5°, 7 pounds of sugar must be added. If the Œnometer shows 8°, only 4 pounds of sugar have to be added, and so in proportion.

This direction, as given by Mr. François, has been since superseded by the following: 750 grammes of wine, accurately weighed, are boiled down to 125 grammes, exactly the sixth part of the original quantity. To avoid all errors, it is best to use the *water-bath* for this process, which we will describe, so as to leave no doubt to persons not well acquainted with chemical terms:

On a trivet, which is placed over a charcoal furnace, a pan is put with a cylinder of copper, which cylinder is filled with water to three fourths of its contents. On this an evaporating dish of porcelain, containing the aforesaid 750 grammes of wine which we wish to boil down, must be placed, and in about three hours we can reduce them to that quantity we wish to use, viz., 125 grammes. After leaving the mass standing in a glass cylinder of 25 centim. in height, and of the same width, to let the tartaric acid settle itself, keeping the cylinder well corked for 24 hours, the proof by the Œnometer can be obtained.

The *Œnometer*, or *Gleuco-Œnometer* (*Fig.* 21), is an instrument similar to an Alcoholometer or Areometer. The degrees are according to Beaumé, and are obtained in the following manner: The instrument is placed in distilled water before the upper end of it, A, is closed. Then quicksilver is poured into it till it sinks to the middle of the tube A B, at which point is fixed the zero of the instrument. Then the instrument is placed in a proof vial (which, as well as the instrument itself, must be wiped per-

fectly dry), containing a solution of 15 grammes of table-salt in 85 grammes of water, and the point to which it sinks is marked B. The space between this point and zero has to be divided into 15 degrees, and a like space above zero must be equally subdivided. The first will show the degrees of sugar a liquid contains, and the latter those of alcohol.

This is the simplest way to obtain a Gleuco-Œnometer, which was first used by Cadet de Vaux. The following is a rectified table, which all wine-merchants use as a guide for the manufacture of Champagne:

Degrees of the boiled-down liquid, as shown by the Gleuco-Œnometer.	Sugar to be added to 225 litres.					
5° below 0	4	kil. sugar,	or	8	bottles	wine-liquor.
6° "	3.4	"	"	6.8	"	"
7° "	2.9	"	"	5.8	"	"
8° "	2.3	"	"	4.6	"	"
9° "	1.7	"	"	3.4	"	"
10° "	1.1	"	"	2.2	"	"
11° "	0.5	"	"	1.0	"	"
12° "	0.0	"	"	0.0	"	"

To estimate the quantity of gas which is developed, we will only calculate the carbonic acid as produced by the sugar. A bottle which has received an addition of 16 grammes sugar (4 kil. to 225 bottles) contains, after the fermentation, 8 gr. 234 mgr. carbonic acid developed out of the sugar. The weight of one litre of this gas, at a temperature of 15° C., is 1 gr. 88 mgr.; consequently, at the same temperature, those 8 gr. 234 mgr. will give 4 litres, 38 gas. Now, taking it for granted that 100 centilitres of wine have the capacity to absorb 99 centilitres, 2384 of gas, we find that a bottle which contains 80 centilitres of wine will absorb 87.39 of gas, and the pressure must amount to 5.4 atmospheres. This is exactly the pressure that is sustained by the bottles where the wine showed 12° below zero on the Gleuco-Œnometer.

This method, though a great improvement for the manufacture of Champagne, is not perfect yet, for it still occurs that 40 per cent. of the bottles burst.

Another method, which has been in practice for several years in the Champagne districts, is this:

The quality of the wine which is to be bottled must first be ascertained by testing it with the Gleuco-Œnometer. Then such a quantity of sugar, which is to be carefully marked, is added as to make the instrument fall to zero.

As, at the time of bottling, the wine has lost most of its saccharine substance by the fermentation in the casks, the Gleuco-Œnometer stands a few degrees above zero. By adding the sugar, the specific gravity of the wine is increased, and equals that of water when the Œnometer stands at zero.

The wine out of which Champagne is made contains always from 10 to 12 per cent. of alcohol, and the other ingredients are present in the same proportion, so that, at the testing of the liquid,

the degrees above zero pointed out by the instrument show in reality the quantity of sugar contained in the wine; for the more of saccharine substance the same contains, the higher the instrument will rise in the liquid. By calculation, we find that to reduce a wine which contains from 10 to 12 per cent. of alcohol down to zero, the same quantity of sugar is required which in the wine that has been boiled down is indicated by 12° below zero on the Gleuco-Œnometer.

This latter method has the advantage over that of Mr. François that the evaporating process is avoided; but then neither method is complete, as by none of them the other ingredients of the wine, and especially the uncombined acids, can be ascertained.

According to analyses of the best wines as regards flavor and sparkling capacity, the wine ought to be composed of

1. 16 to 18 grammes of sugar per bottle.
2. $\frac{11}{100}$ to $\frac{12}{100}$ of its volume of alcohol.
3. Uncombined acids to correspond to 3.5 grammes of sulphuric acid.

Manufacturers of sparkling wine will do well to pay particular attention to this analysis, if they wish to obtain a wine of superior quality.

Manufacture of Sparkling Wine.

After it has been shown how much sugar has been added to the wine, according to the method practiced in the Champagne district, we now proceed to explain the manufacturing process:

For the manufacture of sparkling wine the *blue* grape is generally used in the Champagne district, the coloring matter being extracted out of the skin of the grapes after the juice has been pressed out. I mention this particularly, because in other countries none but *white* grapes are used for this purpose. The blue grape is far preferable, however, because its juice has the capacity to absorb a larger quantity of carbonic acid, which is the main point.

The young wine (must) is first filled into pipes to settle, and is afterward put into hogsheads in the upper cellar, where it remains till it is ready for bottling, which should be done in the shortest possible time, inasmuch as one day may produce a complete change in the wine. It is also advisable to ascertain every morning, by means of the Gleuco-Œnometer, the quantity of sugar it contains.

To facilitate the work and do it with greater dispatch, a faucet (*Fig.* 22) with two separate openings may be used, the key of which must be so constructed that it opens one opening while it closes the other, so that the workman can cork one bottle while the other is filling.

The Bottles.

These must be selected with the greatest care. The following

analysis shows the ingredients of which the glass of a good bottle that had withstood a strong pressure was composed:

Silicic acid	58.4
Potash	1.8
Soda	9.9
Lime	18.6
Aluminum	2.1
Oxyde of iron	8.9
Doubtful	0.3
	100.0

This bottle contained no magnesia; but several of the broken bottles contained some, viz., one bottle 2.4 per cent., and another one 3.6 per cent. Of how great an importance the chemical composition of the Champagne bottles is, the following incident, which occurred in France, will show clearly: A certain glass manufactory used sulphuric alkalies in the composition of their Champagne bottles; the consequence of which was that the wine dissolved the sulphuric particles of the glass, and a beverage was produced which smelled like rotten eggs, and tasted somewhat like the mineral waters of Paràd, in Hungary.

The chief properties of a good Champagne bottle are the following:

1. It must weigh from 800 to 900 grammes.
2. The glass must be of an even thickness.
3. It must never be of a blue or rainbow color, which can be easily detected by wetting the bottle and holding it up to the sunlight in a horizontal position.
4. The glass must be perfectly pure; if but the smallest particle of flint is visible in it, the bottle can not be used with safety.
5. The neck of the bottle must be perfectly conical, so as to better hold the cork.

As it is not advisable to use shot for the cleaning of the bottles, the smallest particle of lead being sufficient to spoil the wine, the cleaning apparatus, which was invented by H. Caillet, is generally used for that purpose, the main piece of which is represented in *Fig.* 23. The bottle is put with its neck in the opening *g* of a flat piece of wood marked *o*, and by the force of the springs *r r* pressed against another piece of wood marked *b*. By means of a winch which, through the cords *c c*, moves the double roll *p*, the bottle, which is partly filled with water, is quickly turned round; and while a stream of water is washing the outside of it, the workman presses the brush marked *k*, which is attached to an iron wire marked *d f*, against it with his left hand, holding with his right one the brush *u x*, which cleans the inside of the bottle at the same time. This apparatus is a double one, as our sketch shows, two bottles moving on the same axle, and from two to six of them are generally turned by one cord. *Fig.* 24 shows the wooden frames on which the bottles are placed during the cleaning process.

The Corks.

The greatest care must be bestowed on the selection of the

corks. They must be perfectly sound, and their elasticity such that they can be compressed to the third part of their diameter without breaking; for, should the elasticity of the fibres be not uniform, the bottle would not be closed hermetically, as the slightest difference in the cylindrical shape of the cork would cause the gas to escape. The best method to avoid great changes in the elasticity of the cork by the influence of the carbonic acid of the wine is to boil them several times in a solution of tartaric acid, and afterward expose them to steam under a certain pressure. Corks are generally prepared in this manner, and with good results. Corks that have been used once can be used a second time —though the iron of the wires and the influence of the wine has deprived them, to a certain extent, of their elasticity—by treating them with oxalic acid. From two to five kilogrammes of this acid are dissolved in 100 litres of water, and the corks soaked in it for about a fortnight, after which the whole mass is boiled, and finally the corks well cleaned in fresh water. The regular size of a cork for Champagne bottles is from fifty to fifty-five millimeters in height, with a diameter of thirty millimeters.

Machines used for Corking the Bottles.

The oldest machine of this kind bears the name of its inventor, "Leroy," and is represented in *Fig.* 25. The horizontal bar O O is furnished with a tube of a conical shape, the opening of which, in which the cork is placed, and a trifle larger than this, has a steel funnel inserted in it, of which the left half is fastened to the side of the tube, while the left one is loose, and connects with a spring marked T V, the strength of which can be increased at will by placing the bar *a* V under the hammer *a*, which is movable. By pressing down the treadle Q, the cylinder F F, and the arm, L G, of a bent lever—the other arm of which connects with the horizontal piece L D—are moved, and by force of the square band L the piece L D is pulled to the left, drawing out the end, T, of the spring T V, and the movable piece of the funnel, which presses the cork down to the lower end of the tube, and so closes it. To prevent the retrograde motion, an iron wedge (which in the drawing will be seen right above D) falls by its own weight into the tube, and forces itself between the movable piece and the upper part of the same. By releasing the treadle Q, the shaft C C is pulled down, which again lowers the rammer A, under which, and on the cap-like shaped stand H, which moves round a horizontal axis, and rests on a powerful spring wound round the roller S, the bottle is placed. By beating the rammer with a mallet, the cork is driven into the bottle about 20 to 22 millimeters deep. By pressing down the key-board, C, which connects with the wedge, this is lifted to its former position, and releases the movable piece of the funnel, which instantly is drawn back by the spring T V, so that the bottle can be easily removed. This ma-

chine works very quick, but, owing to the conical shape of the tube, the cork is not always placed quite straight into the bottles, and so often is the cause of the escaping of a part of the gas.

To avoid this, Mr. Maurice constructed another machine, which is represented in *Fig.* 26, by which the cork is pressed through a cylindrical tube composed of three or four iron plates. The first plate is movable, and forms one of the sides of the machine, E E. The second piece is governed by the eccentric wheel P P, which is fastened to the axis F, and moves also the third plate by means of a side piece in the shape of an inclining plane attached to the wheel. By pressing the handle G down to E, the three plates approach each other and compress the cork, while by means of a treadle like that of the machine Leroy (*Fig.* 25) the cylinder B B is lifted up and the cork driven under the rammer. The balance of the bottling process is the same as described in the foregoing account of the machine of Leroy. As the sharp edges of the iron plates are apt to cut the cork, it is best to have them rounded a little. Lately Mr. Maurice has altered this machine considerably, and the improvements are such that the cork can be driven into the bottle by the same force which serves to fasten the wire over it.

Fastening the Strings.

The bottle is placed in a cylinder of leather, which is fastened to a trivet attached to a stool on which the workman sits (see *Fig.* 27), who, holding the bottle between his knees, places the first noose (represented in *Fig.* 28) over the cork, which is quickly drawn together by pulling at both ends, marked *a* and *b*, the latter of which connects with the ball of twine in the box of the trivet. The second noose is like the first, the only difference being in the turns of the loop between *a* and *b*, of which it contains one less. A good workman in the Champagne district can fasten in this manner from 1000 to 1200 bottles in one day. Before the cord is used, it is necessary to dip the same into linseed oil, to protect it against the dampness of the cellars, which causes the strings to rot, otherwise, in a very short time.

Fastening the Wire.

The wire, which must be of the best quality, is brought into the market in pieces already prepared for the purpose (see *Fig.* 29). The workman who puts on the wire sits on a similar stool like that one represented in *Fig.* 27, except that the cylinder in which the bottle is placed is a wooden one. The open ends, *b*, are placed around the neck of the bottle, and by pulling the wire over the cork, both ends, *a* and *b*, are united and twisted by means of a pair of shears (*Fig.* 30), the points of which serve to cut off the rest of the wire.

As it takes from two to three years before the wine is fit for the market, and as the strings are apt to rot, Mr. Maurice has pre-

pared a wire fastening, of which we give a drawing in *Fig.* 31. This is put on before the bottle is corked, as its upper opening is large enough to admit the cork, and afterward fastened in the manner shown in *Fig.* 32. This fastening saves the labor of putting on any strings whatever, and in ten hours a good workman can cork 1000 bottles and put on the wire at the same time.

After the bottles have been so corked and wired they are piled up from 20 to 25 high, in the following manner (see *Fig.* 33): The first row of bottles, B l, rests with the necks on five laths, marked l, and those of the second row, B′ l', on another lath, marked l', which is laid over the lower ends of the first row, and so the pile is built up, care being taken that the outside bottles are steadied by a small wedge of cork. This kind of piles can withstand a great pressure from outside, and have the advantage, at the same time, that each single bottle can be taken out for examination at pleasure.

Storing the Wine in the Cellars.

To develop the sparkling, the greatest possible care must be taken as to the temperature in which the wine is kept. Some manufacturers keep the bottles in the fermentation-room in a very high temperature till the sparkling has fairly commenced, and not till then they remove the wine to the cellars. Others keep the wine in the cellars, and only bring it into the fermentation-room when the sparkling process is going on too slowly.

There are cellars in the Champagne district in which the temperature seldom rises above 3° or 4° C., and as many cellars contain three different stories, which communicate by openings in the middle of the floor that can be hermetically closed, it is easy to produce a change in the temperature of the different cellars. When the development of the carbonic acid proceeds regularly, it is not necessary to expose the bottles to a very low temperature; but when the fermentation goes on too quickly, this becomes necessary, for the bursting of one bottle destroys at least five or six others; and as as many as 7500 bottles are stored together in fifteen different piles in most of the larger cellars, this breaking might become very fatal to the whole mass.

In order to reduce the temperature, which rises to 18° or 20° C., fresh water or ice-water is poured over the bottles during the coolest time of the day, either before sunrise or after sunset, and the cellars are well ventilated. If this does not prove of sufficient avail, the wine is removed to a lower and cooler cellar.

Most of the cellars are provided with sinks to carry off the water, as shown by *Fig.* 34. The floor $a\,b$, $a'\,b'$, $m\,c$, $m'\,c'$, has an inclination of $\frac{1}{50}$. The channels $b\,c$, $b\,c$ are 80 centimeters broad by 3 or 4 centimeters in depth, and contain large sinks, marked O O, at a distance of every 10 meters, in which the wine from the broken bottles flows.

The Aphrometer.

To ascertain the correct time for the removal of the bottles, the *Aphromter* (*Fig.* 35) is used for measuring the pressure of the gas. By means of a hollow screw, which contains a movable cylinder *t t*, the point of which is called *V*, this latter is driven into the cork of the bottle after the wire has been removed and the cork been cut even. The movement of the cylinder is governed by the knob B, fastened to it by a small screw marked F, and by the female screw E, in which the male screw of the knob is inserted. The gas rises through *t* into the tube *h*, *l*, *i*, and, by turning the handle *y*, is admitted into the Manometer, which has been previously filled with water, and by another screw, marked G, connects with the frame *f*, *h*, *l*, *r*. This Manometer, which has been invented by Bourdin, shows exactly the number of atmospheres the pressure of the gas in the bottles amounts to.

After the fermentation process is completed, the dregs of the wine must be removed. For this purpose, the bottles are placed on stands of 1 m. 60 in height by 0 m. 90 broad, as shown in *Fig.* 36. Each stand has 10 rows of bottle-holes (6 holes in one row), of oval shape, on each side, the largest diameter of which measures 10 and the smallest one 9 centimeters. It answers the purpose best to place the bottles at an angle of 30° to 35°. *Fig.* 37 shows a simpler way of placing the bottles in a position to make the sediment of the wine settle on the cork.

To facilitate the gathering of the dregs, it is necessary to shake the bottles a little at different times. As the sediment of the wine is often slimy, and sticks to the glass, the following solutions of tannin and alum are used to prevent this.

1. *Solution of Tannin.*—200 grammes of pure gall-nut tannin are dissolved in alcohol of 95° C., so as to give one litre of liquid, which is sufficient to clear 16 casks of wine of 100 litres each. This is equivalent to 12 grammes ; 5 of this solution for one cask, or 62.5 for one litre, or 50 milligrammes for one bottle.

2. *Solution of Alum.*

Pure gelatine	16 grammes.
Alum	8 "
White wine	1 litre.

The wine is heated, and in a decilitre of it the alum is dissolved, and the gelatine in the residue. The whole is mixed when it becomes lukewarm. A quarter litre of this liquid suffices for 200 litres of wine. The sediment produced by the mixture of gelatine and alum with tannin is always pulverous, does not adhere to the glass, and produces a very clear wine.

Fig. 38 shows the way in which the dregs are removed. The workman places the bottle inverted on his left arm. After having removed the wire and strings with the common hook (*Fig.* 39), he presses the finger of his left hand on the cork, which he extracts by means of pincers (*Fig.* 40). The foam is let into a small cask, marked *c*, leaning toward the workman, out of which it runs

into a tub, marked *t, p, o*, having a sieve, *t*, to keep the sediments back. If the dregs are not entirely removed by the force of the explosion, the fingers must do the rest of the work. Corks that will not give way easily are removed by a simple contrivance, as represented in our drawing. The loss of wine caused by this operation averages about 6 centilitres per bottle.

After this cleaning process sugar must be added. Formerly this was not done; but now, in a bottle of 80 centilitres are put 24 and even 26 centilitres of sugar-liquor. The common liquor consists of

150 kilogrammes white candy-sugar.
125 litres wine.
10 litres spirit of cognac.
285 kilogrammes, or 200 litres.

Liquor used for the English Market (1 *cask*=200 *litres*).

Sugar	50 kilogrammes.
Water	15 litres.
White wine (Champagne out of the vat)	20 litres.

The sugar is dissolved in warm water and mixed with the wine, after which the liquid is boiled down to 50 litres. When the liquor is cold it weighs 35°. Then are added,

Port wine			38	litres.
Spirits of cognac			10	"
Common cognac			5	"
Brown cognac			8	"
"Fismer" dyeing matter			2	"
Liquor. Sugar,	50	kilogrammes	87	"
White wine,	20	litres		
Cognac,	15	"		
Cherry brandy,	1	"		
Raspberry brandy,	0.1	"		
			200	"

Liquor for England, mixed, without being Boiled.

Common boiled liquor	100	litres.
Pure liquor	20	"
Port wine	30	"
Madeira	8	"
White wine (Champagne)	10	"
Spirits of cognac	12	"
Cognac	12	"
Brown cognac	6	"
"Fismer" dyeing matter	2	"
	200	"

To each cask are added 2 litres of the following mixture:

Water	60	litres.
A saturated solution of alum	20	"
" " tartaric acid	40	"
" " tannin	80	"
	200	"

The Fismer dyeing matter, which yields one litre of liquor, consists of

Extract of elder-berries	250–500	grammes.
Alum	30– 65	"
Water	600–800	"

The liquor is generally poured into the bottle by means of common tin cylinders, with a handle and a pipe of conic shape, the opening of which measures 10 or 12 millimeters. This instrument has been improved by H. Mosbach, of the house of J. Mummés, as shown by our drawing in *Fig.* 41.

H. Cameaux has constructed a machine (*Fig.* 42) by which the work of putting the liquor into the Champagne can be performed with great regularity. The cylinder P, which is supported by B B, C C, E E, and G, contains the chamber of the pump, made of glass, and graduated into centilitres. The liquor is pumped into the chamber by the lever A″ A A′, to which the cylinder T is fastened, out of a glass or stone jar, *b*, and through *a* passes into the bottle, which is placed on the stand H. The overflowing wine runs into the bottle *m′* through the tube D D.

As it is rather difficult to keep this machine clean, and as the tube *a* D D must be made of silver in order not to injure the wine, and, moreover, as a great deal of the carbonic acid is set free by the pumping operation, it is not recommendable.

H. Machet Vacquant, of the house of Moët, has invented another machine which is far preferable. We give a drawing of it in *Fig.* 43. A glass vessel, A, with a cover, which is fastened by the screw B C, contains the liquor. F is the measure, which is completely filled by the liquor in order to exclude all atmospheric air. The stand G is controlled by the treadle R, and the gas can be let off by the faucet H.

We will add a few remarks concerning the preparation of the liquor: Liquor that is made without being boiled must be stirred often, and the spirits of cognac must not be added before the sugar is completely dissolved in the wine. Liquor that is boiled must be allowed to become perfectly cool before the other ingredients are added—the alcoholic liquids as well as the dyeing matter—as these materials get deteriorated in their flavor by heat. The liquor is strained through a flannel bag lined with calico, and partly filled with paper pulp, which must be well mashed.

Fig. 44 shows the tub out of which the liquor runs into the filtering-bag, and the cask in which the latter is suspended; also the club used for mashing the paper. Before the wine is put up in baskets and sent to market, it should lie for a week or two.

The mixtures used for sealing the bottles up consist of

1 kilogr. of white pitch, and
1 do. of yellow rosin;
or,
2 kilogr. of yellow rosin, and
1 do. of yellow wax;
or,
2 kilogr. of yellow wax, and
1 do. of turpentine;

or,
1 kilogr. of turpentine,
1 do. of shellac, and
1 do. of yellow wax.

These mixtures are dyed either with red ochre, ivory black, or Prussian blue and chromate of zinc, which gives a fine green color. They are mixed in the following proportions:

1 kilogr. of red ochre;
0.5 of ivory black;
0.5 of a mixture of 1 kilogr. of Prussian blue to 2 kilogr. of chromate of zinc.

Often some mica or gold-dust is added, in the proportion of 100 to 200 grammes to 1 kilogramme of pitch. Minium, chromate of lead, cinnabar, or any other preparation of quicksilver, must be carefully avoided.

Improvement in the Manufacture of Sparkling Wine, by L. Jaunay and E. Maumené.

The practice of cleaning the wine of the dregs and adding the liquor, as described in the foregoing section, causes a loss of about 25 per cent. of the wine. This loss is guarded against by the invention of Messrs. L. Jaunay and E. Maumené of an apparatus (*Fig.* 45) which is so constructed as to prevent the wine from being exposed to the atmospheric air and the escaping of the carbonic acid.

After the dregs have been removed, the wine is poured into a ball-shaped vessel, marked S, filled with carbonic acid, which holds from 20 to 30 bottles. The bottle B is placed on the stand *a*, in a frame marked *c c c c*, which moves on hinges. The springs *r r* press the bottle against the opening of the tube, which connects with the vessel S. By turning the frame upward, the equilibrium between the gas in the bottle and that in the vessel S, which has been previously made to correspond with the atmospheric pressure which the gas exercises in the bottles, is produced, and the bottle is placed in a vertical position, so that the wine runs into S through the tube *t*, which is plated with galvanized silver. As the wine flows out the bottle fills itself with gas, the equilibrium of which with the gas in the gasometer G is produced by lowering the frame to its first position. Now the liquor is poured into the bottle, and this is then placed under the stopcock R, and filled again from the vessel S through the silver-plated copper pipe v R′; the equilibrium of the gas being first produced by turning the cock R″ of the pipe marked *t*. Then the bottle is corked and the wine put on.

We will now explain the working of this apparatus in all its details: After the atmospheric pressure of the gas sustained by the bottles has been ascertained by the Aphrometer (represented in *Fig.* 35), the vessel S is filled with so much carbonic acid as to

be equal to that in the bottles. The gas is prepared in the following manner (see *Fig.* 46):

The cask A is filled with chalk or carbonate of lime (limestone) and water. The opening C is then closed hermetically, and sulphuric acid when chalk, chloric acid when limestone is used, is poured through the leaden funnel B into the cask. The carbonic acid thus developed is conducted through the pipe D into a smaller cask filled with water, marked E, and from there through another pipe, F, into the glass stand G, filled with small pieces of chalk, which *bind* the last particles of free acids. Through the pipe X the pure gas is led into the gasometer G (*Fig.* 45). This is a bell-shaped vessel, of tin or tinned copper, which hangs in a vat of the same metal, marked M F, filled with water up to two inches from its margin, and is balanced by the weight P″. By turning the stopcock *d* the gas is conducted into the gasometer, flows through *d′* into the forcing-pump P, while by a third stopcock, marked *d″*, the gas returning from the vessel S is admitted again into the gasometer. The pipes which connect the different cocks are made of India-rubber. The pressure of the gas is measured by a small Manometer, marked *m*.

By means of the forcing-pump P the gas is driven into the *condenser* A′ through the pipe *i*. This is a copper cylinder plated with tin, and holds $1\frac{1}{2}$ hectolitres, the sides being from 3 to 4 millimeters thick, in order to have sufficient strength to sustain a pressure of 20 atmospheres, which is the amount of gas required for one day's work. The condenser rests on a board, marked *f f′*, and is fastened to the wall by means of an iron ring *g g*, wound round with rope, and is furnished with a stopcock, marked *r″*, which serves to let off the water that gathers in the cylinder. The atmospheric pressure is measured by the Manometer M.

Through the pipe *i′ t″ r′* the carbonic acid is let into the vessel S, and the pressure regulated in the following manner: The pipe *v′ v″* conducts the gas into a cylinder of India-rubber one centimeter thick, which is closed by two round pieces of the same material, fastened to bronze plates, one of which is fixed, while the other is movable, and is pressed down by the gas putting in motion the pieces *z* and *y*, the teeth of the latter piece, turning the wheel, gradually closing the cock *r′*, through which the gas is let into the vessel S.

By the elasticity of the India-rubber and a spiral wire which is wound round the cylinder, the plate is drawn back, and so the stopcock opened again; and by this alternate opening and closing of the entrance to the vessel S, the pressure is regulated. To still increase the power of the regulator, a spring, Z, is attached to the movable bronze plate.

The Vessel S (*Fig.* 45).—By pressing down the treadle *p*, the piece *f*, which is furnished with a spring, is pulled down, which moves the ring *h*, to which the piece *k* is attached, so lowering

the stand *d d* on which the bottle is placed. On releasing the treadle, the springs *r r* press the bottle against a circular piece of India-rubber in the middle of *c c*. Take now the *plateau c c*, move it forward so as to turn it over the body R of the stopcock, which forms part of the upper plate *c c;* thus the frame *c c*, *c′ c′* is brought in the position indicated by the punctuated lines, and the bottle is in B. After this semicircular motion the gas in the interior of the bottle is balanced by that in the interior of the ball S.

This is plain if we examine *Figs.* 47 and 48, in which the stopcock R is represented in detail (one fourth size in *Fig.* 47, one half size in *Fig.* 48, with the same letters in both figures). The body R is represented by the letters A B D E. It consists of a piece with a plate C F (*Fig.* 47), and the piece of the cylinder *d d′*, furnished with a thread of a screw, fastened by a vice of bronze *b b′*, the use of which is to keep the circular piece of India-rubber in its place, against which the head of the bottle V is pressed. The lower metallic mass of C D E F contains two round grooves; to the vertical one *r r′* is screwed a silver pipe *r″*, at the lower extremity of which a flexible pipe *r′ r″* is fastened, long enough to reach the bottom of the bottle. The other groove *z v*, thrice as broad, is intersected by the first at *d d′;* it inclines about 40° to the left, and extends to the key at *v*.

This key of the cock is immovable; it consists of a long furrow T T′ T″, and its conical part has four openings from D to E. The first one, *i*, terminates the furrow *m m′*, which is to receive the carbonic gas; the second, G, opens the furrow G H, through which the wine runs into the ball S.

These two openings lie in the vertical plane T *i* T′; the two other ones are 45° from this place and the centre of the cock *m* (*Fig.* 49).

The one, *u*, lets the gas escape which entered by *m m′*; the other, *y*, is the entrance of another branch arm *y o*, of a second furrow *o o*, with an opening by the same key, 3 or 4 millimeters back of *m m′*. This furrow terminates in a second branch arm *o′ y′* (a little to the right of point T), and the opening *y* corresponds with the furrow *y′* N, intersected by the stopcock N. The furrow *m m′* shows a stopcock O R between T′ T″. This cock has three passages; the furrow T″ connects with the furrow X″, which lets in the gas from the regulator or condenser. The vertical furrow T‴ joins the furrow X′, which connects with the ball S.

Now the treadle is pressed down, and the bottle, after the dregs have been removed, is inserted in the frame. The grooves *r r′* and *v z* are closed by the key of the cock; the wine is in a vessel which is hermetically closed. The frame is taken off, in order to turn the bottle upside down, so as to give it the position *v′ z′*. While this is going on the body of the cock first brings the open-

ing r before u, and, without stopping, there is sufficient time to let the gas compressed in $m\ m'\ u$ enter the flexible pipe $r\ r'''$.

The equilibrium of the pressure can thus be brought about in the bottle and in the ball; one moment only is necessary for it. As soon as the bottle is brought in a vertical position, the wine enters at once the ball, without the slightest degree of sparkling.

When the bottle is emptied, the frame must be moved back and kept a little while at the angle of 48°, in which position there is a connection between the opening r and the arm $y\ o$ of the branch groove $y\ o,\ o'\ y'$.

The object of this proceeding is so plain as not to need any explanation. The pipe $y\ o,\ o'\ y$ connects with $y'\ t$ V, a second pipe on the gasometer G (*Fig.* 45). The gas compressed in the bottle enters the branch pipe as soon as r is over y. All gas exceeding the pressure of one atmosphere enters the gasometer; the remaining gas fills the bottle completely, and can not expand in the moment when it is taken from the frame. A slight motion puts the frame back into position B.

When the bottle has got its dose of liquor it is brought under the cock A′ (*Fig.* 45), where it is held, as shown in the illustration. It is now wrapped up with wire-cloth. The cock v is all the time open. The person that attends to the filling opens the cock A″, by which the gas enters from the ball, and establishes the same pressure of gas in the bottle and in the ball. Then he opens the cock R′, and the wine at once flows smoothly into the bottle, settling above the liquor without any disturbance. As soon as the bottle is filled the cock R′ is closed and the treadle released, the corking quickly done with a temporary cork, and the bottle put up for market.

The construction of the cork A′ deserves an explanation for itself: d (*Fig.* 50) represents the extremity of the pipe t' R‴ of *Fig.* 45; the gas from the ball flows through this channel into the bottle, and enters it at i. The cock R′ must be as close as possible to the extremity P, whence the wine flows into the bottle. This is indispensable, and it is for this reason that the cock has the complicated shape shown in *Fig.* 50.

The wine flows out of the ball through the pipe v R′ (*Fig.* 45). The extremity of this pipe at R′ is marked by the letter a, *Fig.* 50. The hollow vice into which the bottle is put in order to press against the circular piece of India-rubber is furnished with wings (*Fig.* 51).

When the vice has been tightly pressed around the India-rubber, it becomes necessary to guard against its getting loose. The envelope of wire-cloth is suspended to the vice, and it is continuously moved, first to turn it backward when the bottle is put in, then forward when the gas enters the bottle, in order to protect the hands of the workman in case of bursting. To prevent the

vice from getting loose it is fastened by a check-pin, which is represented in *Fig.* 50.

By the working of this apparatus no wine is lost. 81,080 bottles, with an addition of 20 per cent. liquor, put up in this way, render 100,000 bottles, which, at a price of 5 francs per bottle, gives a surplus of 99,500 francs.

ADULTERATION OF WINE.

The following general rules may be observed by any person who should wish to prove or to buy wine:

1. The judge of wine will be principally guided by the smell and the taste.

2. If several wines are to be tasted in succession, it is well to rinse the mouth every time, to extinguish the taste of the preceding wine.

3. It is well to observe from what part of the barrel the wine was drawn. On the top the wine is mild and weak; in the bottom it is hard and strong; in the middle it is the best.

4. When the wine is to be tasted it must not be too cold or too warm; 8° to 10° R. is the best temperature. At the trial of different varieties clean glasses should always be used.

5. It must be considered at what season of the year the wine is tasted. In March and April it is generally in motion, and chemical decomposition happens, which temporarily affects the taste; the same is the case during thunder-storms and strong gales.

6. If a glass filled with wine is to be tested, we must see if it is transparent, if it sparkle, and in what manner. Old wines sparkle beautifully; young wine has more tendency to foam. Then may be tried if the smell of the bursting bubbles are pleasant, fresh, animate the sensibility, and are delicious or distasteful. A little wine may be taken in the palm of the hand, then rubbed, and tried by the sense of smelling.

7. A good wine should have the following qualities: It should be transparent, light, bright, shining, not too pale, and be of pleasant smell and taste. The after-effects upon the tongue must be durable. It must not be sour; at the same time, not quickly intoxicating. Poured in a glass, it should sparkle beautifully; measured with the Areometer, it must never be more heavy than water. If chemical reagents be applied to wine, the following reactions, after Mulder, may be observed:

1. *Chlorite of Iron.*—It colors the wines blackish, as they contain tannin; on the increase of the blackish color may the quantity of tannin be decided. *White wines:* Bordeaux-Sauterne produce almost no coloring; Champagne a slight indication; more perceptible are Teneriffe and Madeira; the same in Osomorer, Magyarader, Somlauer; strongly in Rhenish wines, Steinbruch, Szadaer; very dark in Côtes, Bergerac, Muscat, and Lacryma Christi. *Red*

wines: Port wine is the least affected; more so Tavella, Hermitage, Langlade, Burgundy, Beaune, Erlauer; the most, Bordeaux, Burgundy-Tommard, Narbonne, Benicarlo, Rousillon, St. George, Apszer, Szegszarder, Ofner, Adelsberger.

2. *Isinglass* forms a sediment of tannin.—*White wine:* no sediment of Bordeaux-Sauterne; hardly perceptible in Teneriffe and Madeira; light sediment in Rhenish wine, Champagne, Muscat, Côtes, Bergerac; strongly in Lacryma Christi. *Red wine:* the least in Port wine; little more in Burgundy; more so in Tavella, Hermitage; the most in Langlade, ordinary Bordeaux, St. George, Burgundy - Tommard, Narbonne, Benicarlo, Rousillon, Apszer, Szegszarder, Ofner, Adelsberger.

3. *Chloric Water* will form a sediment and change color.—*White wine:* in Muscat, Bordeaux-Sauterne, Rhenish wine, Côtes, Bergerac; but little in Teneriffe, Madeira, and Champagne; strongest in Lacryma Christi. *Red wine:* strongest in Tavella, Langlade, Port wine; less affected Burgundy, St. George; the least in Hermitage, Bordeaux, Burgundy-Tommard. Through the blue sediments which have been formed will appear muddy: Benicarlo, Rousillon, Narbonne, Tommard, Hermitage, Bordeaux, Burgundy, Szegszarder, Apszer, Adelsberger.

4. *Nitrate of oxyd of Silver* causes white sediment.—*White wine:* light in Rhenish wines and Champagne; more in Madeira, Muscat, Côtes, Bergerac, Bordeaux-Sauterne; yet more in Teneriffe; very much in Lacryma Christi. *Red wine:* very little in Bordeaux, Port wine, Hermitage, Tavella, Langlade, Burgundy-Tommard, St. George; much more in Narbonne, Benicarlo, Rousillon. Adding nitric acid to the sediment will dissolve the same again; the most with Tommard, the least with Benicarlo.

5. *Ammoniac.*—It changes the color. *White wine:* all will appear brown; the least, Champagne, Côtes, Bergerac; the most discolored are Bordeaux-Sauterne, Madeira, Teneriffe, Rhenish wine, Muscat, Lacryma Christi. *Red wine:* the fluid part will be brown; the coloring matter will be altered. Port wine and Tavella will obtain the color of Rhenish wine. Of dirty brownish-green color will be, the least affected, Burgundy; more so, Hermitage; the strongest, Bordeaux, Langlade, Burgundy-Tommard, St. George, Rousillon, Narbonne, Benicarlo.

6. *Oxalic Ammonium* forms a sediment.—*White wine:* the least, Champagne; more in the following order: Sauterne, Rhenish wine, Muscat, Madeira, Teneriffe, Lacryma Christi, Bergerac; the most in Côtes. *Red wine:* the least, Langlade; more in St. George, Bordeaux, Burgundy, Port wine, Hermitage, Rousillon, Tommard, Narbonne; the most in Benicarlo.

Sugar of Lead forms flocky sediment. All sediment dissolves in nitric acid, through which red wine will receive a lively red color. *White wine:* the least perceptible, Lacryma Christi; more in Champagne, Muscat, Bordeaux-Sauterne; yet more in Rhenish

wine, Madeira, Teneriffe; the most in Bergerac and Côtes. *Red wine:* the least in Port wine (dirty brown); more in Savella (dirty white); yet more, Burgundy, Langlade (both pale blue, violet); more in Hermitage, Burgundy-Tommard, Benicarlo (dark blue, violet); the most in Bordeaux, St. George, Narbonne, Rousillon (pale blue).

8. *Alum.*—In white wine, no change; in red wine, heightening of the red color. An addition of a few drops of a solution of cali until some sediment will form, shows, Tavella, dirty sediment; the others, a dirty blue sediment (this reaction is uncertain, as the color will depend upon the quantity of alum and cali; much alum will itself color the sediment violet or pale red).

The adulteration of wine may be in many forms, according to the nature of the different wines. The wines may be divided:

1. Sweet or liquor wine, with or without a superfluity of sugar.
2. Sour wine, rich in tartaric acid, poor in sugar, as Rhenish wine and Moselle.
3. Wine rich in alcohol, as Burgundy.
4. Wine which contains much tannin, as most French wines do.
5. Sparkling wines; Champagne.

Port wines contain the most ingredients of alcohol, which originated not altogether from the transformation of the grape-sugar; but they always receive an addition of spirits of wine. All liquor-wines are, on account of their ingredients of sugar, alcohol, flavor, and their color, subject to adulteration. All wines—even the most sweet—contain free acid. Free acid of vinegar is found in from $\frac{1}{4}$ to $1\frac{3}{4}$ thousandths. Tavella contains the least, Madeira the most. At the same time, wine contains sulphuric acid. Free tartaric acid is from 2 to 3 thousandths in wine, as well as free pyromalic acid.

All the sugar in the grape-juice is not, during the fermentation, transformed into alcohol. In Rhenish, Moselle, Burgundy, and Bordeaux wine, the sugar is not perceptible. By experiment, one ounce contains: Sherry, from 4 to 20 grains of sugar; Madeira, 6 to 20 grains; Champagne, 6 to 28 grains; Port wine, 16 to 24 grains; Tokay, 34 grains; Samos, 88 grains; Taratte, 94 grains of sugar. The red wines would taste unpleasant if they did not contain about $\frac{1}{2}$ per cent. sugar.

Adulteration with Water.

A chemical conviction is not possible. It may be, for instance, that pure wine contains 12 per cent. alcohol, and the wine supposed to have been treated with water only 8 per cent.; then the taster may rest assured that the supposed adulteration has taken place.

Adulteration with Cider.

This process is chiefly used with white wine. A small quan-

tity of this wine forced to evaporate will leave a large remainder behind, which, thrown on hot coals, will invariably smell like apples or pears. Or sulphuric acid thrown over the sediment will cause the same smell.

Adulteration with Alcohol.

This can not be detected chemically if the alcohol has been added some time previous. Adulterers know the quantity of alcohol required in the pure wine, and are not apt to add more than required to evade detection. If water and alcohol were added at the same time to the wine, the adulteration may be proved by comparing the specific weight of this wine with the same of pure wine.

Young Wine which has turned Sour.

This will often be cured through soda, pipe-clay, gypsum, etc. If lime or clay is added to sour wine to neutralize the too much concentrated tartaric acid, then will it be impossible to find these substances afterward in the wine. The superfluity of the tartaric acid will combine with the lime, and gradually settle to the bottom. Did the wine turn sour from actual formation of vinegar, and these substances were applied, they remain suspended as acid of vinegar. Oxalic ammonium will form in such wine considerable sediment, and is sufficient evidence that soda, lime, gypsum, etc., were used. If potash has been added to sour wine, it will remain in the wine, by preceded formation of vinegar, acid of vinegar, etc.

Happily there are now cheap modes to take away the sour taste of wine, and only few adulterers will use litharge; formerly this was much practiced. A considerable addition of sugar will lead to suspect that it is intended to cover the sour taste. Through distilling the acid of vinegar may be proved; it must be noticed, at the same time, that every wine has free acid of vinegar.

Through Alum.

By this the color of red wine will be heightened, and made more fiery. The wine will through it be more durable for transportation. At the same time, alum covers the addition of water, and imparts to the wine a Bordeaux-like flavor. To detect alum lime-water may be put in wine. It must then remain quiet for two days, after which tartaric acid, crystals of lime, are formed when no alum is in the wine. The absence of this will prove the alum in the wine.

Lime.

This is frequently used to clarify, to discolor, and to take away the sour taste of the wine. If lime remain dissolved in the wine, oxalic ammonium will form a white sediment.

Tannin.

This is much used to improve the taste and the color, as well as to guard against casualties of the wine. The quantity of tannin may be calculated if a solution of gelatine is so prepared that in 100 parts of weight of the same, one part in weight of tannin, which was dissolved in 100 parts of distilled water, will settle to the bottom.

Tartaric Acid.

If free tartaric acid is found in wine, it may be presumed that it came there artificially. To be convinced of this, take one part of wine, two parts of dissolved chlor-kalium, and the same heated under continual stirring to 15° C. If the wine contains tartaric acid as suspected, artificially added, in eight to ten minutes a white, crystalline sediment of *cremor tartari* will form. Natural wine will only, after an elapse of several hours, form a sediment. That the crystalline sediment is actually *cremor tartari*, the following will prove: this sediment must be dissolved in a very little distilled water, which is heated; then is added some dissolved lime. It will form a new sediment of tartaric lime, which, if a little solution of muriate of ammonia is added, the lime will dissolve.

Manufactured Wine.

It may be that there is wine in market which contains no grape-juice, and in which potatoes have replaced grapes. For such wine are taken cider, potato sugar, dissolved with water in a particular proportion, left over to ferment, during which a higher temperature than at the fermenting of grape-juice is required. Afterward this compound is completed through the adding of alcohol, sugar, and aromatic substances. To make the deception striking is added to the wine *cremor tartari*, a little sulphuric acid, some free acid of vinegar, or pyromalic acid and tannin.

Imitated Champagne.

The real Champagne sparkles differently from the imitated; one part of the oxygen is dissolved in the Champagne; it sparkles much longer; and should the bottle stand open some time, the wine in it will yet contain much oxygen. With imitated Champagne this is not the case; the oxygen will escape soon. If Champagne is evaporated, the real wine will only leave a trifling of sediment; the imitated, under the same circumstances, considerable.

Coloring White Wine.

A common method to give white wine a beautiful, deep, golden-yellow color is the adding of burned sugar; or a small quantity of nitrate will do the same service.

Coloring Red Wine.

From experiments made by Mr. Mulders there is in all natural red wines but one body of coloring matter. Mr. Mulders has produced this substance of color in a pure state. Extracted with spirits of wine, it will produce a red tincture. As different colors in combination with different acids produce different colors, so is it with the color in the husks of blue grapes. Free acid of vinegar, pyromalic acid, sulphuric acid, tartaric acid, give to the wine a more light and fiery red color. Burgundy, which contains the least free acid, has a very dark color.

EXPLANATION OF PLATES.

Fig. 1 represents an *Improved Safety-Faucet.* 1 is the body of it without the stopper, seen from above; 2 is the perpendicular, cut by the line *a b* in fig. 1; 3 is the side view of the stopper; 4, the same seen from above. The pin *d* of this latter turns in a circle-shaped furrow of the body, running concentric with the openings. In 1 it appears visible by the dotted circle *e e*, but clearer in *e e* of 2. The stopper can only be put into and taken out from the body when the pin *d* is put in the direction of the fold *f*, and pushed through this. If this pin stands beneath that fold, the cock is open and the liquid flows out; if it gets turned off from the place *f*, it is locked. The perpendicular pin *g* serves as a mark, which, in the first case, appears turned off from the cask; in the latter, toward it. When the cock is fixed into the cask, the pin in 3 can only be moved by the key 5, made of bone, hollow at its end, and exteriorly triangular. In order to open the faucet or to lock it, the key is put upon the pin *h* and the triangular hollow about it. The body of the faucet and the stopper are made of wood; the pins *d*, *g*, *h*, of brass; the ring, *k*, of iron; and the mouth, represented in 1 and 2 by *n*, *n*, are lined with cork.

Fig. 2 shows the *Safety-Cock* of Christian, made of metal—I the side view; II the cut; III the view from above. On the upper end of the plate *a* is a tube-shaped piece *b*, in which *c* is movable. This piece *c* is pressed against the stopper *e* by the action of the spring *d*, and fits into the screw *f*, which runs perfectly around to a place *i* in IV, where it gets interrupted by a tooth-shaped part of the metal. This tooth *i* leans against the piece *e*, and prevents the turning. From the other side the stopper *e* is held fast by a pin *j* in III, which leans against the end of a section *l*. This latter is so constructed that the stopper *e* can make the necessary rotary motion if *l* don't hinder it. The end of *e* is a screw. In order to open the cock, take the key *k*, in II and VI, whose hol-

low is the mother-screw to *c*, and that draws the piece *l* back when screwed in, by which action the stopper *c* gets free, and can be turned by its handle. V represents two views of *c*, the spring *d* of the tube *b*, into which the cap *m* is firmly to be fixed after *c* and *d* are put in.

Fig. 3. *Oechsle's Must-Scale.*—A is a hollow glass cylinder, filled almost to its brim with must. The instrument is composed of the "float" *a*, which holds it suspended, and the "point of gravity" *b*, having the purpose of keeping the instrument continually in a perpendicular direction. The scale C is divided into degrees, from 50 to 100, by lines. After inserting the scale into the must a careful observation must be taken, when it don't play any more, to what degree-line it has sunk down. This line indicates by degrees the weight of the must. The instrument, and the mode of using it, are described at length in Appendix C, pages 257, 266, which see.

Fig. 4 represents the *Acid-Scale*, composed of three parts: I, the "Flask;" II, the "Pipette;" III, the "Burette." The object of this instrument is to ascertain the quantity of acids in the must. The Acid-Scale, and the mode of using it, are described at length in Appendix C, pages 264, 265, which see.

Fig. 5. The *Fermentation* or *Safety Tube.*—After filling the cask about nine tenths full with must and sugar mixture, this is put into it. Its form is a curved tube *a*, whose longer limb is put air-tight into the perpendicularly perforated bung *b*, and the shorter one 2 to 3 inches deep into the vessel *c*, half filled with water. The length of the former must be about 8 inches, the other about 6 inches, and the upper curving part also 6 inches long.

Fig. 6. *Closed Fermentation Tub.*—A represents an ordinary tub of optional size, whose upper lid *a* has a slanting rim, as *b a* or *f a* show. This lid has two openings 4 inches wide: the one, *g*, to insert the safety apparatus B into; the other, with the stopper *d*, to fill the tub through. In order to remove the lid easily, the four upper hoops are fastened together by a strong screw, *e*. By loosening these a little the staves will part so much that the lid may be easily taken out by inserting the hands through both the openings *g* and *d*. The *fermentation bottom*, K and I, is formed by a perforated board, *k*, of 1 to 1½ inches in thickness, fixed upon two lasts, and four wooden sticks, *i*, penetrating these. By means of the wooden pins *m m*, and several perforations of those sticks, the bottom *k* can be put higher or lower, according to option. The perforated cock *r*, whose downward pointed mouth is locked by the stopper *o*, serves for taking the proofs. Close over the bottom *p* is a tap-hole, into which a tin tube is put when the wine is to be drawn off, in place of the cock *q*. C is a support 12 or 15 inches high, facilitating this business.

Fig. 7. "*Ebullioscope*," or "*Alcohol-Scale* of Mr. G. Conaty."—This is composed of a small kettle, C, of red copper, that may hold

50 to 60 cubic centimeters of liquid. This goes exactly down to the middle of the brass stove T, heated by a spirit lamp. It is to be almost filled with wine, covered by the round lid *p*, to which the thermometer has to be fixed, and to be brought to boiling. The degrees up to which the quicksilver rises at the boiling point also indicate the alcohol parts in the wine. See, also, the "Vaporimeter" illustrated, and its mode of operation described, in Appendix C, pages 289, 290.

Figs. 8, 9. *Separator* for separating the grapes from the stems.—A cylinder, C D, composed by wooden sticks lying horizontal above the receiving tub, in which the grapes are shaken by means of wooden dashers, *a b*, *c d*, fixed to the axle M G (*Fig.* 9). A box, A B, stands upon this cylinder, into which the grapes are thrown. Two cross-sticks put through the hooks *c c* serve to lift the whole apparatus upon the tub. The berries, getting separated from their pedicles, fall through the interstices into this latter, and are taken out through the door *p*.

Fig. 10. An apparatus by which the *carbonic acid gas* escaping during the fermentation of the wine-must may be turned to use. The end, *t*, of a conducting tube, let into the fermentation tub, may be so arranged that it is brought into a barrel, *e*, half filled with water. This extracts all foreign vapors out of the gas, which then is conducted by a tube, *t′*, into a second barrel, C, filled with crystallized carbonic acid natron. The gas gets absorbed by this salt, and settles by being changed into double carbonic acid natron by the action of the carbonic acid. From C the gas goes through the tube *t″* into the barrel C′, where it undergoes the same change. This double carbonic acid natron must then be dried, and will form an amply paying equivalent for the trouble of its making.

Fig. 11. "*Fermentation vat* of masonry," sometimes used instead of wooden tubs.—M M are the upper walls of the vault, through which a circle-shaped opening, S, goes with slightly slanting sides. Upon these lies a caoutchouc ring, C C′, about 1 centimeter thick, serving to close the stone slab, *a a*, S, air-tight, which has 3 iron rings, *a a*. The screw V, which goes through the iron cross-piece F, fixed by clamps let into the slab stones, holds it tightly closed against any pressure of the carbonic acid from inside. P H is a double door—P the inner wooden door, H the outer one, of cast iron; both are firmly pressed by the screw V′. Z is a spout through which the sediments are drawn off, and the water used for cleaning the vat. I R is a tube to let the fermented wine off; *t* is the tube to let the gas off through; *x* another opening, serving to screw a third tube into, or to take some wine out from above. T is a thermometer. The benefits derived from such vats are their holding the warmth better than wooden tubs, allowing the fermentation a very regular course, and their capability of being heated from outside in cold weather, in order to bring the temperature of the walls up to 100° C., the most proper for musts of low temperature.

Figs. 12, 13. Instrument used in *Sulphurating* wine-casks.—In order to do this, a piece of linen is dipped into boiling sulphur and allowed to dry. This then, 2 to 3 inches long, is fixed to the hook, lighted, and held into the cask. To avoid the dropping off of the charred linen into the wine, the following apparatus serves well (*Fig.* 13). C is an earthen vessel, with holes through it, which has to be fixed to the bung B by 3 iron wires twisted together underneath the rim C and the lower end of the vessel at *m*. The sulphur-cloth is then put into this latter, ignited, and let down into the cask. The sulphur burns off, the sulphurous gas escapes through the holes into the cask, but of the charred cloth itself nothing can fall into it.

Fig. 14. Sebille Auger's *Hydraulic Bung.*—This is formed by a cone, A B, made of tin, around which runs a plate, C D, filled with water. The upper end A is covered with a cap E, having small holes through its lower end. After the bung B has been inserted, it fits tightly by the aid of the small segments below. The gas rises in A B, from there into the cap E, where it escapes through the lower holes and the water into the air.

Fig. 15. Masson Toux's *Hydraulic Bung* needs no farther explanation, as the figure gives it sufficiently.

Fig. 16. Maumené's *Bung.*—B is an ordinary bung, perforated lengthwise, with its upper end widened a little to allow the leaden valve S to fit into it. The handle *m m*, of sheet iron, serves this latter, and the end of a caoutchouc tube, *c c*, to hold it. A slight inside pressure is sufficient to lift the valve and to let the gas escape.

Fig. 17. *Siphon* used for drawing the wine off from one cask into another. It is made of tin, and has at the point of its part A a small tube, *t*, with a mouth-piece, *s*. This tube, *t*, goes at *m* into the elevating arm. Then the arm C is let into the wine, holding the instrument fast by the hand C F. The cock R must be closed, and the air drawn from out the instrument by applying the mouth to the mouth-piece *s*. The wine enters the vacant space also at *m*, and rises through the tube to the mouth. By opening the cock R it flows over, and may be so transferred to another cask.

Fig. 18. *Apparatus for Drawing off Wine* from a cask without bringing it into connection with the air. T is the full cask, and T′ the one into which the wine is to be transferred. A faucet cock (*Fig.* D) is put into T; into this a head of the leather hose *m* is to be inserted. Each head is a hollow wooden cock, 20 to 25 centimeters long, 6 centimeters thick at its upper, 3 centimeters at its lower end, and bearing upon the former a ring to make it tightly fit into the hose (*Fig.* G). Now the cock is taken out of T′, and the tube *b′* is driven in by a wooden mallet. When the connection has been performed, the stopper on cock C is turned, and the half of the wine in the cask T will immediately flow over

into T′. The bellows S are then introduced into the bung-hole of T. At the end is a draft tube, *k*, with a valve inside, opening only from above to below. This draft tube is to be put air-tight into the bung-hole; the lantern-shaped end, however, has to be fixed to a hoop of the cask by the hook *r*. The bellows forces the air to the surface of the wine without clouding it. The air compressed in the cask will then drive, by its pressure, all the wine from out of T into T′. When the air enters the hose, indicated by a piping sound, it must be stopped, the cock at *c* be closed, and the bung of T′ carefully put on.

Fig. 19. *Apparatus to produce Carbonic Acid Gas.* (See the "Manufacture of Sparkling Wines.")—The tube F coming out of a cask (not represented in the cut) conducts the gas from below to the middle of the cask G, which is filled with pieces of chalk, below of larger size than above. The upper lid of G has a hole to insert the copper tube H, which has to be screwed to a gutta-percha tube, L, of several yards length. Through this tube the gas gets into the cask P. If several casks are to be treated in this manner, the one P, filled with the diseased wine, must be taken instead of an empty one. The bung is taken out, and the conical bung M put in instead, through whose middle a tin tube goes. The carbonic acid gas goes now over into the cask P, filled with wine. In this the gas exercises a pressure observable through the tube *v* of the vessel G. This latter is made of glass, and closed by a cork stopper in which are two round holes. One of these takes in a copper tube, *z*, glued to the tube H, to conduct the gas into the glass vessel. Into the second hole comes a straight glass tube, 60 centimeters long, which is divided by degree-lines, and enters the water 2 centimeters deep, with which the vessel is half filled. When this has risen to 20 centimeters, the cock R is opened to let the wine off, only so far, however, as to keep the water in the glass tube always at the same height. The wine is transferred by the vessels S into new well-sulphurized casks. No. 2: As soon as No. 1 is empty, the bung M is taken out, and a large funnel placed upon its hole; at the same time, the cock R must be closed. Then the bung M is put upon another cask, No. 3, to let the wine off. This is poured through the funnel into No. 1, and the operation in this manner continued from No. 4 into No. 3, the wine of No. 5 to No. 4, and so down to the last into which the wine of No. 2 is transferred.

Fig. 20. An apparatus after the method of Mr. H. Payen, improved by Maumené, *to produce Tannin Matter from Galls*, in order to improve diseased foaming wines. Nut-galls are powdered finely, and filled into a glass eprouvette N, where it gets fastened by a cotton wick. A mixture of alcohol and ether is then filled into the globe E, which has to be warmed by water. The vapors rise through the tube *t*, become condensed in the globe B, and fall as a liquid upon the nut-galls, extracting them continually in this

way. The vapor not condensing goes over to B′ or B″, whose stoppers have safety-tubes going down to the bottom; *s* is a lid to prevent the water from being thrown out in the tube. Very little ether condenses in B′, and still less in B″, but in case it does it may easily be prevented by closing the door of the stove a little, and pouring cold water upon the globe E. The ether in B″ evaporates immediately, enters B′, and thence B. No ether at all, therefore, is lost. Two layers of liquids are formed in the globe; the upper one is a solution of gallic acid in ether. This ether is taken off and evaporated over a water-bath. The result will be the desired product = the tannin.

The remaining illustrations (*Figs.* 21–50) are fully described in the preceding article on the "Manufacture of Sparkling Wines," pages 327–335, which see. Here is appended simply their subjects:

Fig. 21. The *Œnometer*, or *Wine Must-Scale.*—See page 327, and also Appendix C, pages 257, 266.

Fig. 22. *Double Faucet*, for bottling wines.—See page 327.

Fig. 23. *Caillet's Cleaning Apparatus.*—See page 328.

Fig. 24. *Frames* for holding bottles.—See page 328.

Fig. 25. *Leroy's Corking Machine.*—See page 329.

Fig. 26. *Maurice's Corking Machine.*—See page 330.

Figs. 27, 28, show the manner of tying the cords.—See page 330.

Figs. 29, 30, represent the *wires* and *shears* used for securing the corks.—See page 330.

Figs. 31, 32. *Maurice's Wire Fastening.*—See page 331.

Fig. 33. *Piling Bottles.*—See page 331.

Fig. 34. *Cellar* for storing wine.—See page 331.

Fig. 35. The *Aphrometer.*—See page 332.

Fig. 36. *Bottle Stand.*—See page 332.

Fig. 37. Another mode of *Packing Bottles.*—See page 332.

Figs. 38, 39, 40. *Removing the Dregs.*—See page 332.

Fig. 41. *Mosbach's Funnel.*—See page 334.

Fig. 42. *Cameaux's Charging Machine.*—See page 334.

Fig. 43. *Machet Vacquant's Charging Machine.*—See page 334.

Fig. 44. *Tub and Pestle.*—See page 334.

Fig. 45. *Jaunay and Maumené's Apparatus.*—See page 335.

Figs. 46, 47, 48, 49, 50. *Parts of Jaunay and Maumené's Apparatus.*—See pages 336–338.

Fig. 1

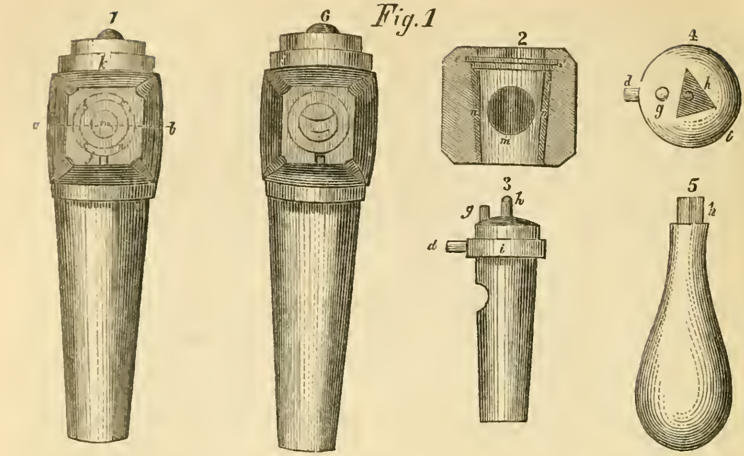


Fig. 2.

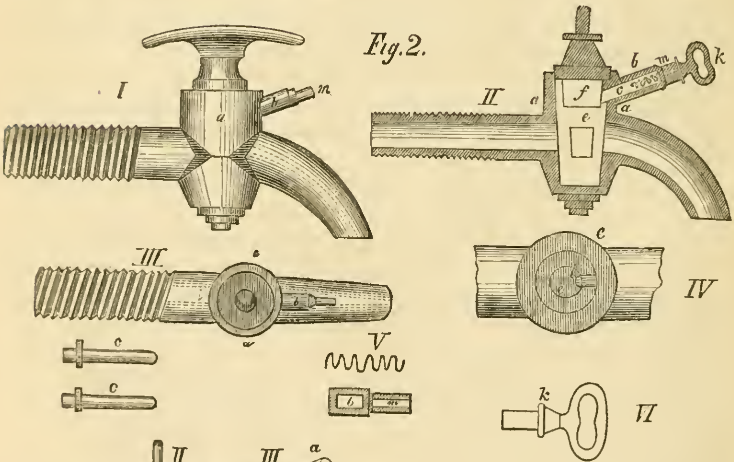


Fig. 4.

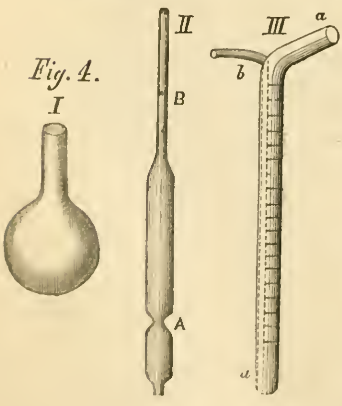
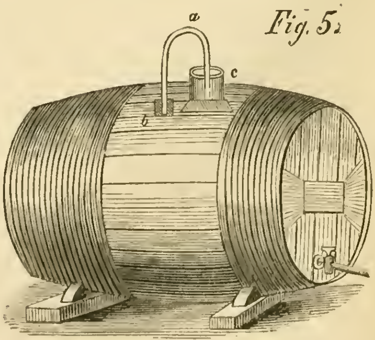


Fig. 5.



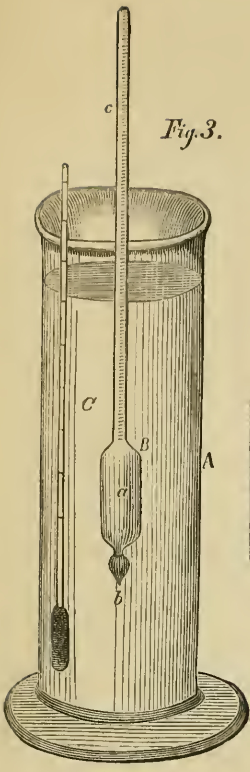


Fig. 3.

Fig. 8

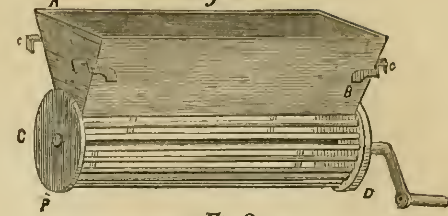
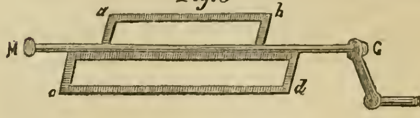


Fig. 9



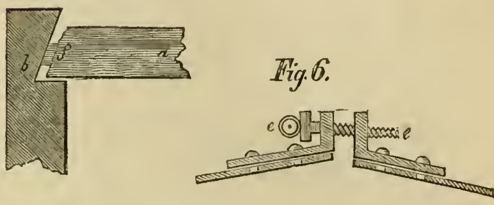


Fig. 6.

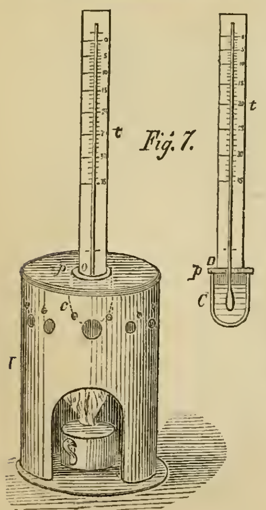
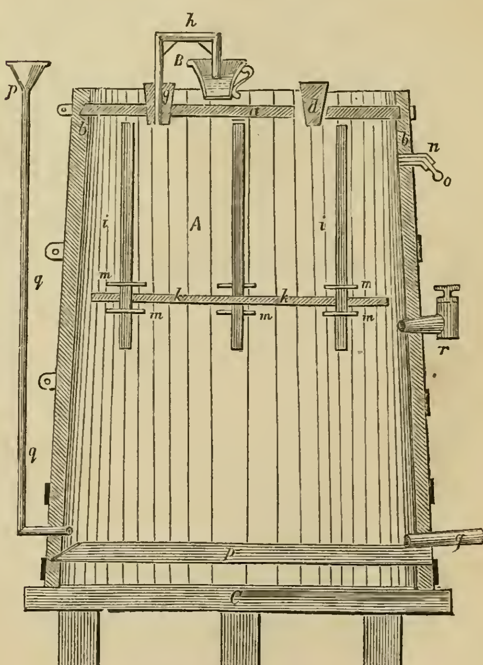


Fig. 7.



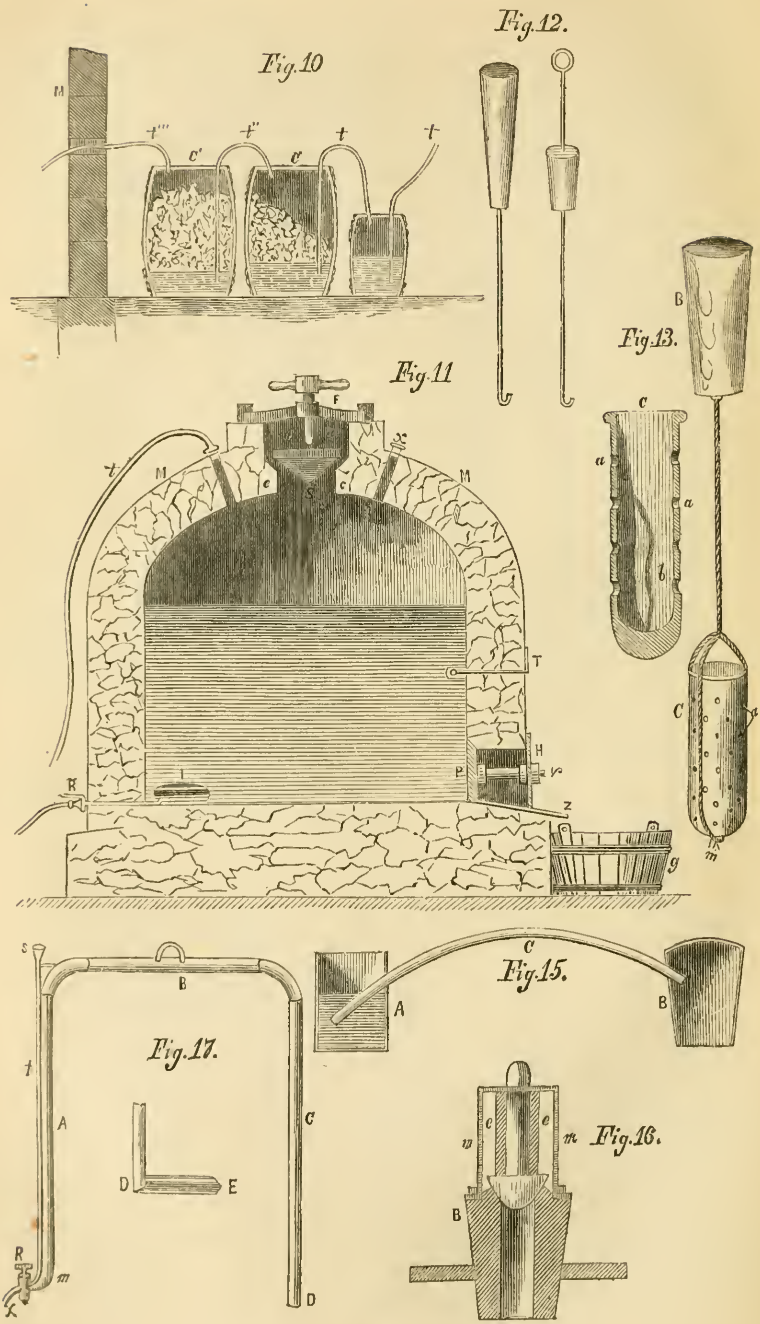


Fig.10
Fig.12.
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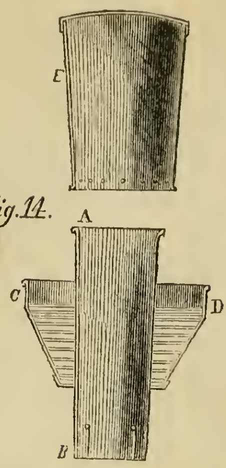

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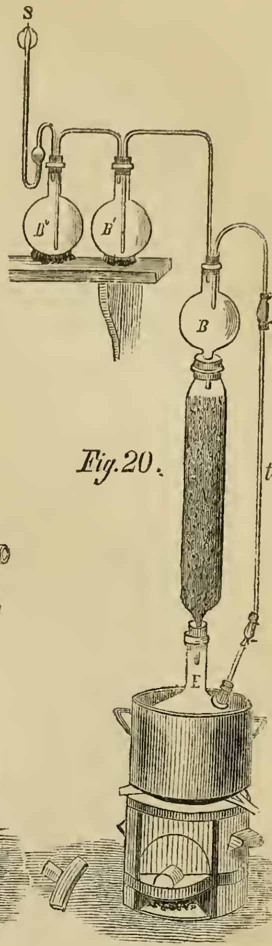

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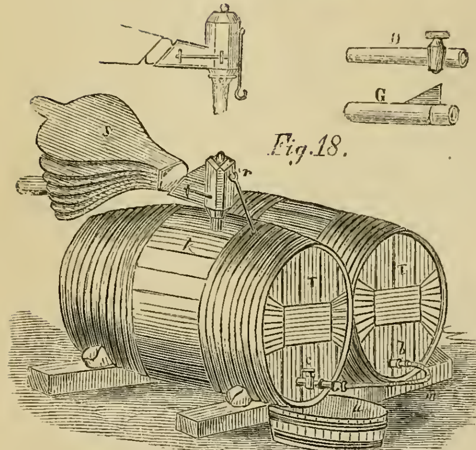

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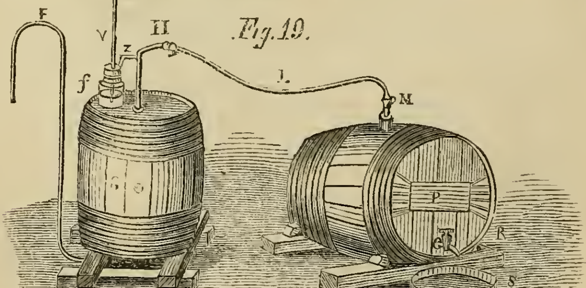

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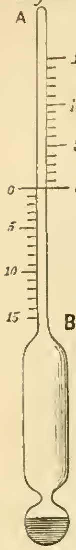

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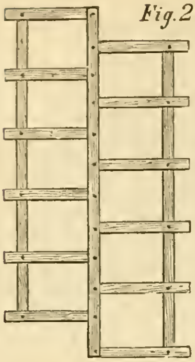

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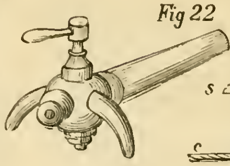

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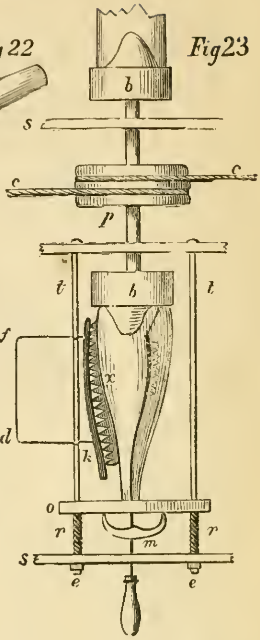

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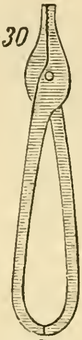

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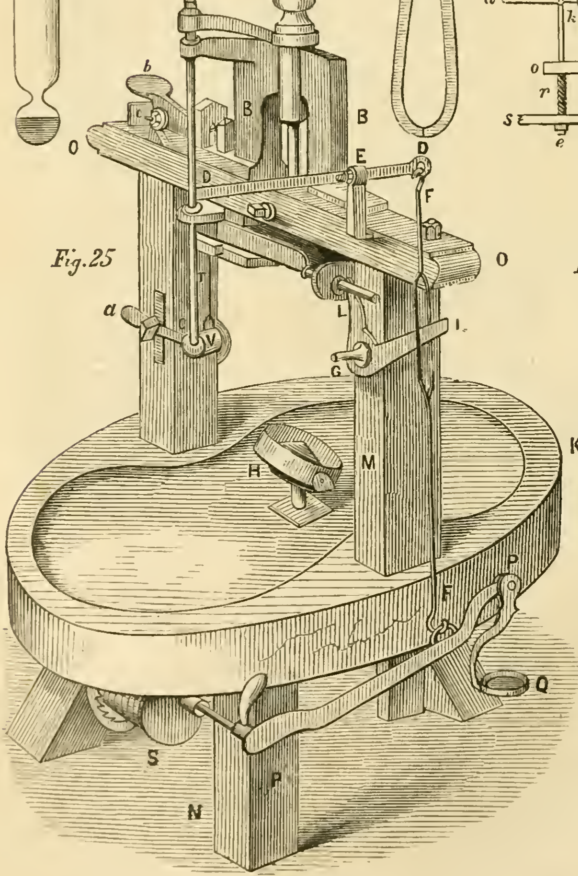

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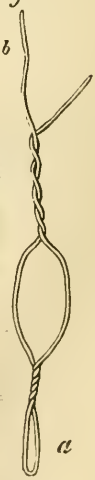

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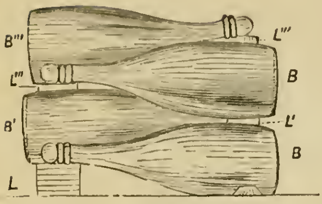

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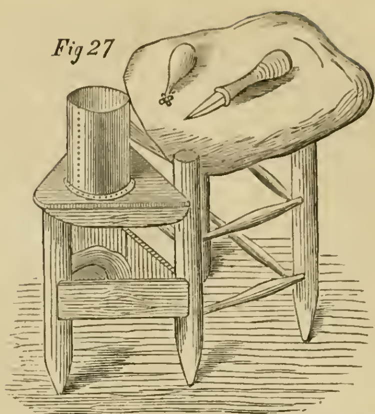

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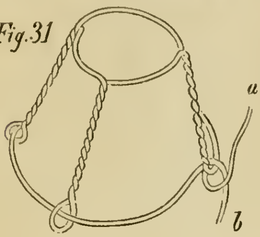

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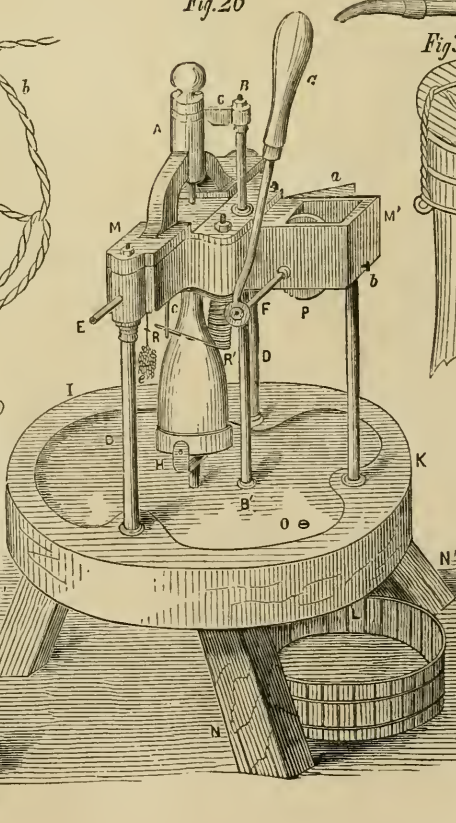

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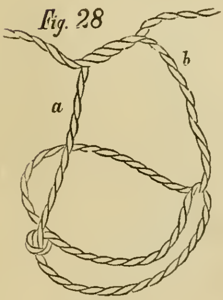

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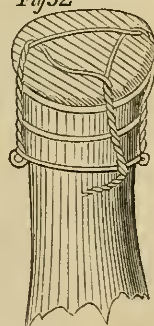

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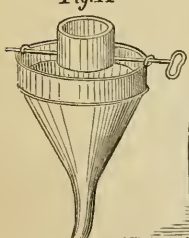

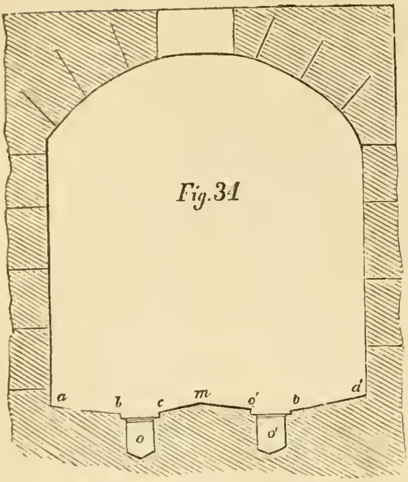

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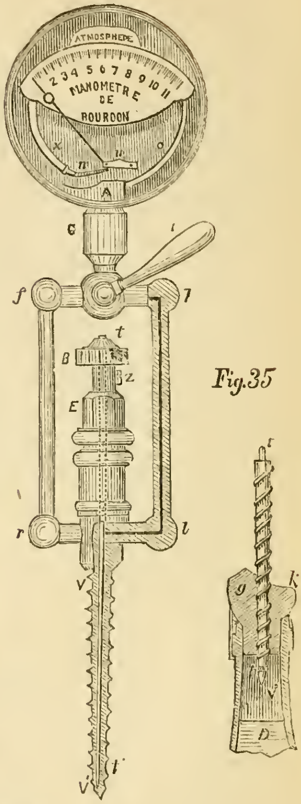

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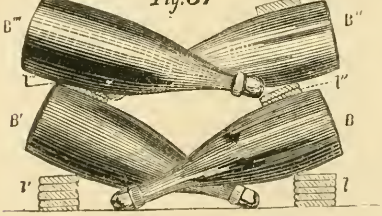

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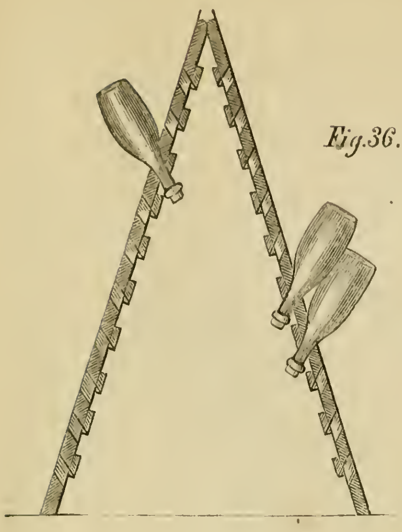

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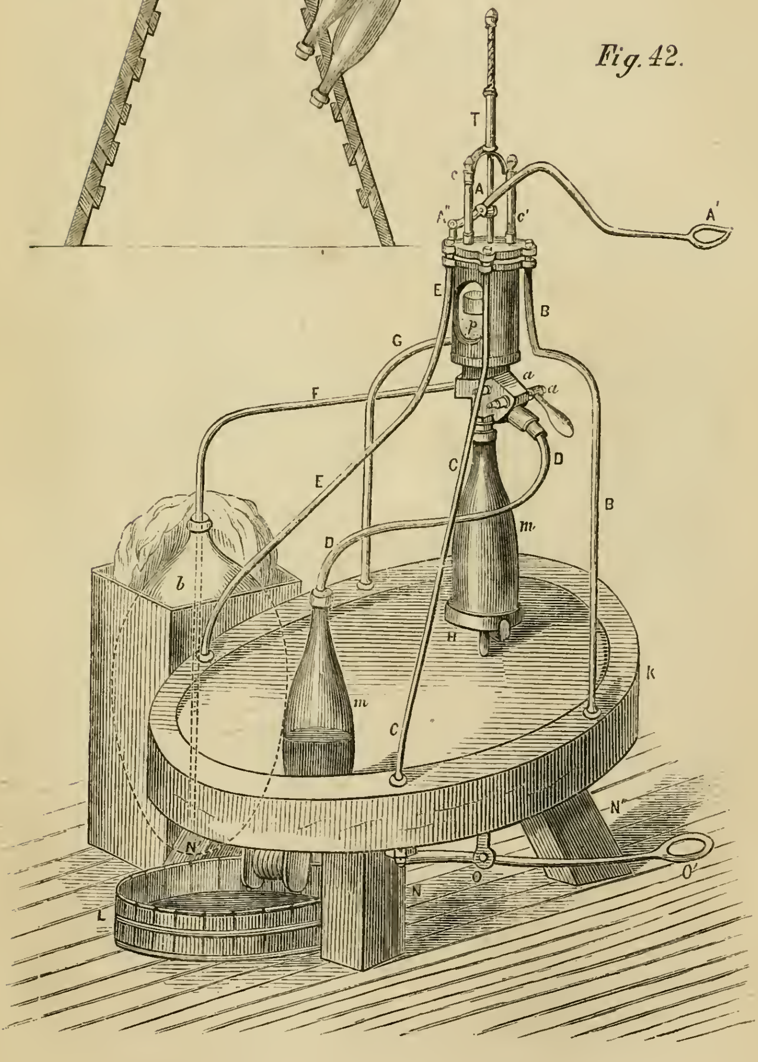

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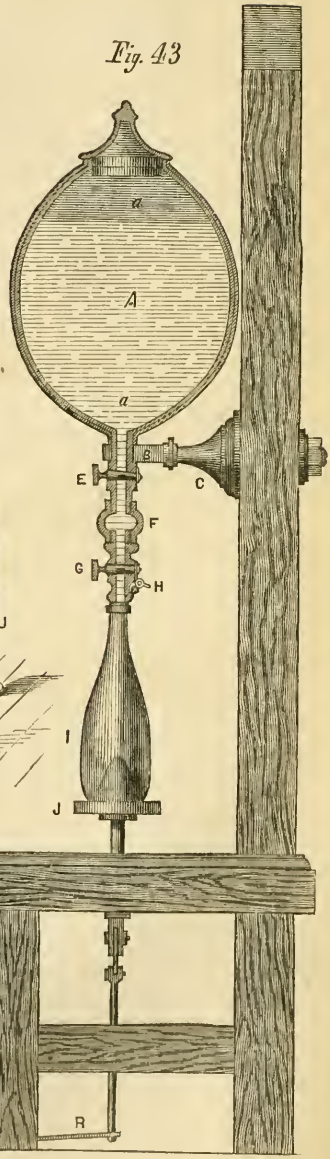

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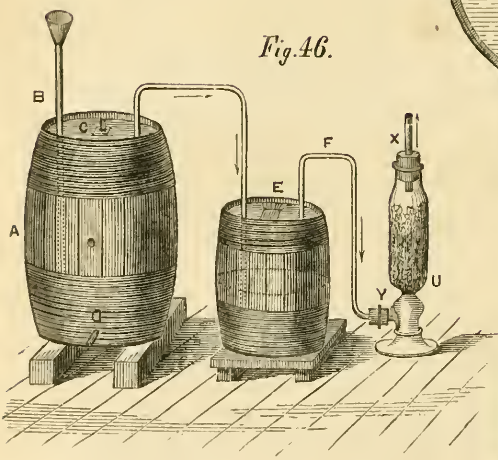

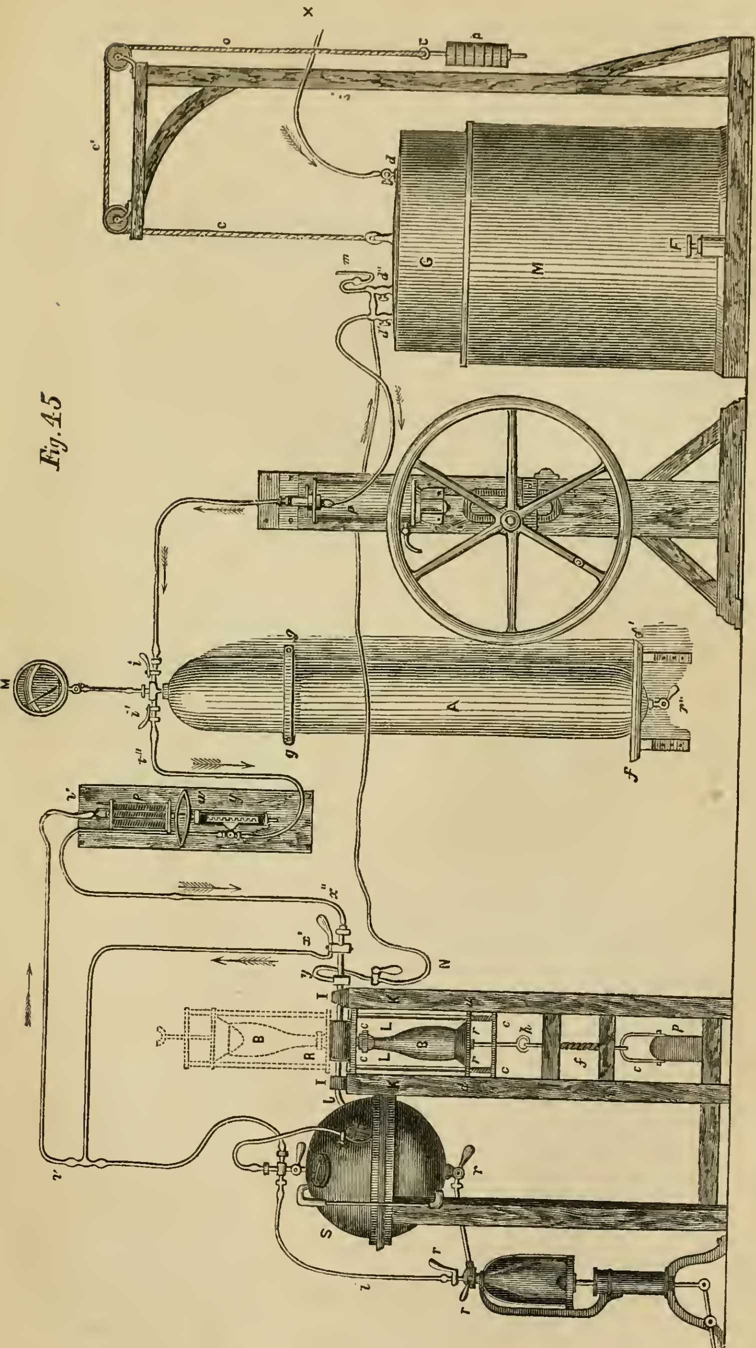

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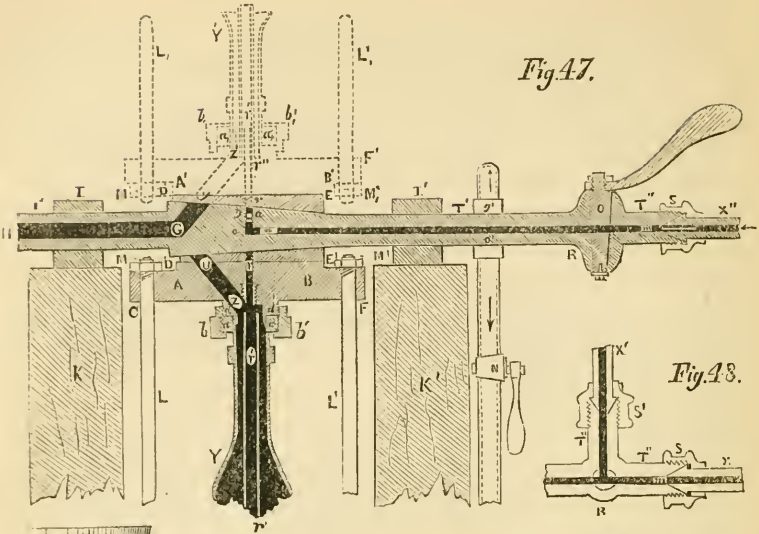

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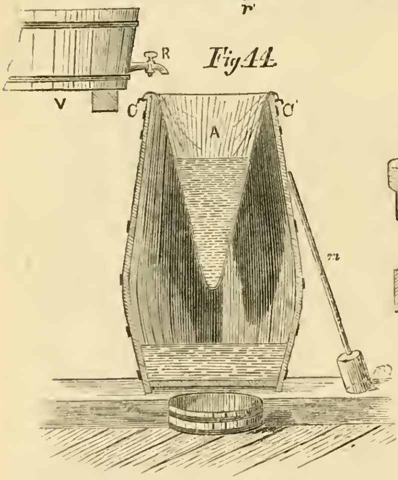

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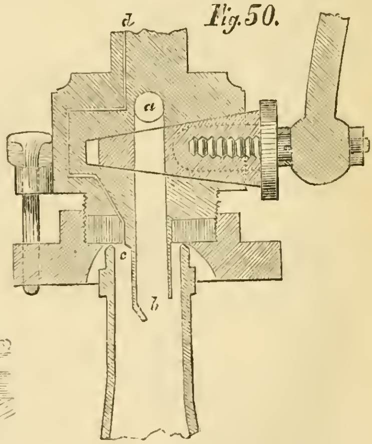

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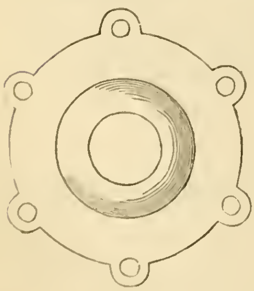

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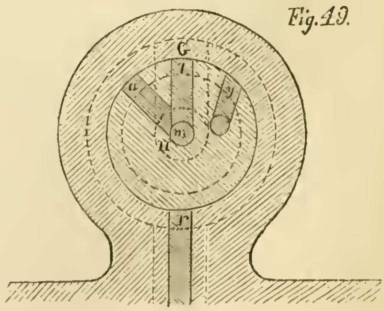

Fig.49.

APPENDIX F.

DRYING FRUITS.

EXTRACTED FROM THE WORK OF EDWARD LUCAS.

APPENDIX F.

E. LUCAS ON DRYING FRUITS.

General Rules.—The Drying-room.—Drying in Ovens.—In heated Rooms.—In the Air and Sun.—Drying Quinces, Plums, and Cherries.—Expenses of Fruit-drying in Germany.—Apples and Prunes.

General Rules.

THE following may serve as common rules for drying of fruit:

1. All fruit required for drying must have attained its full development and ripeness to produce a good article. Stunted, undeveloped, as well as stained fruit, is unfit for this purpose.

2. Over-ripe fruit is not adapted for drying. An exception are few varieties of hard, fleshy pears.

3. Worm-eaten fruit must not be taken. If prunes and plums remain long on the tree, the worm-eaten fruit will fall off, and the gathering will be a choice quality.

4. Sour, as well as pure, sweet kernel fruit produce a poorer dried article than such in which sugar and acid are contained in a balanced proportion.

5. All apples intended to be dried should be peeled and freed of the core, for these will not become mellow if boiled. Pears make an exception in this regard, for which reason they are often dried, not being peeled nor the core taken out.

6. Small and middle-sized apples may be peeled and freed from the core, and then dried whole. Large apples are best to be cut in four or six pieces.

7. If peeled fruit is brought immediately into the heated drying-room, it will preserve a fine pale color.

8. Plums should only be taken for drying when fully or over-ripe.

9. Kernel-fruit drying requires, in the beginning, a temperature of from 60° to 80° R.; afterward from 40° to 50° R. will answer well.

Fruits which can boil in their steam, if only for a short time, will dry better, and will be more sweet and palatable than that which is not steamed. When it is observed that the fruit is steamed, the operation should be continued at a more moderate temperature.

10. If fruit is dried very slowly, and at a continual low temperature of heat, it will be sour. Apples intended to be dried in the air should be brought into a heated drying-room first, through which they would gain in sweetness.

11. No variety of fruit should cool slowly in the drying-room; it would lose its appearance and beautiful gloss. The nice gloss is attained if the fruit is brought hot out of the drying-room, and suffered to cool rapidly exposed to the air.

12. Fruit which is dried several times and allowed to cool quickly will attain more sweetness.

13. Fruits destined for the drying-room should never be piled on top of one another.

14. If fruit is dried too much it will be tough when boiled.

15. Stone-fruit must be dried gradually at the commencement to prevent the running out of the juice.

16. Stone-fruit required to be freed of its stones should be partially dried, at which time the stone will separate from the flesh by a light pressure.

17. Only dry air, which is not impregnated with moist steam, is fitted for drying of fruit. For this reason, the air must be regulated so as to answer the purpose.

18. All fruit coming from the drying-room should be allowed to dry a few days in the air before it is packed.

19. Fruit intended to be packed air-tight does not require to be dried so much as that which is to be packed in the common style. Fruit packed air-tight often contains one eighth of its weight of water.

20. Dried fruit must never be packed when it is warm. Should must or worms affect the fruit, it should be placed in a bake-oven after the bread has been taken out, to dry it. If the fruit is kept in dry and airy places, it will keep from six to ten years without losing much of its quality.

The Drying-room.

To form a general opinion of the advantage of the different drying-rooms, and particularly of the communication of heat, a few points may be remarked:

All drying-rooms have to expel more or less quantity of moisture out of fruit intended to be dried by the means of heated air. Those moist vapors have to be removed from the drying-rooms, which may be done if the construction has openings on the top for the escape of strongly-heated moist air; or pipes may be placed on the bottom to allow the moist moderately heated air to escape.

It is proven that kernel-fruit will improve if, at the commencement of drying, the entire steam is kept in the room, and the fruit almost boiled soft in the same. This can only be attained completely if there are two separate drying-rooms constructed, of which one is entirely closed, and heated from 60° to 80° R., and the other ventilated and heated at the highest to 50° R. In Germany it is acknowledged by all learned men that fruits boiled in their own steam dry faster, and will be more savory than that dried at a temperature below the boiling point. The required heat for drying may be generated by different heating apparatus.

The frames on which the fruit is exposed to dry may be light trellis or wicker-work, with boards a couple of inches high around the sides to prevent the fruit from falling off the frames.

The description of a small drying-room, which contains about 300 pounds of fruit, and finishes the drying in 24 hours, is as follows: It is 6 feet 6 inches high, 3 feet 8 inches long, and 2 feet 6 inches wide. The lower part of this construction is the hearth, 1 foot wide and 6 inches high. It is divided into three parts, of which each contains three frames for the reception of fruit. The smoke is carried off through a sheet iron pipe, 8 inches by $2\frac{1}{4}$ broad, which goes in snake form under and over these three partitions until it is let out of the top. This will show that the heat is pretty equally distributed throughout this drying-room. Another small pipe is placed on the top to promote the escape of moisture.

If it is required to dry fruit in a bake-house, it is essential that the heat of this shall not reach that point which is required for baking bread, as the fruit would burn. After the bread has been taken out of the oven the fruit may be placed in it, when it will dry well. Fruit may be dried in heated rooms; but, as the vapors evaporating are very unhealthy, this mode is not advisable.

To dry fruit in the air and exposed to the sun is the cheapest, but, in every regard, the most imperfect method of any. The fruit is threaded on a string, and hung up in the air, and if the weather is favorable it requires little or no attention.

Quinces.—The ripe quinces are peeled, cut into four to six pieces, freed of their seeds, and dried at a heat of from 70° to 80° R.; farther they are treated as apples or pears. They will retain their beautiful color, and will keep for a number of years.

Plums and Prunes.—These fruits should attain the highest state of ripeness before they are taken from the trees. The gathering should be performed only in dry and fine weather. If circumstances do not allow to bring the prunes immediately to the drying-room, they may be kept in a good ventilated place for a length of time. It is necessary to spread the fruit as much as possible. When the plums are brought to the drying-room, they may be dried from five to six hours at a heat of from 35° to 40° R.; after which the heat must be increased, and the escape of air entirely prevented. The fruit is taken hot from the drying-room and allowed to cool in the air, by which means it will retain its beautiful gloss, and will improve in weight and quality. Some prunes will contain from 20 to 22 per cent. of water, which does not hinder its preservation. A means of making prunes appear very large is this: The fruit is freed of the stones when half dry, and a small plum inserted in place of the stone. The drying process is then finished. This can only be detected by the most minute examination.

Cherries.—All the different varieties of cherries are well adapt-

ed for drying, more especially, however, the hard and fleshy ones. Cherries require to dry slowly; the sun will be the most valuable help; and, after they have lost considerably in bulk, they may be taken to the drying-room to be finished.

It may be well to remark that all dried fruit should be exposed to the air from four to six days after leaving the drying-room. That the different varieties of dried fruit are to be kept by themselves is a matter of course.

Expenses of Fruit-drying in Germany.

Apples and Pears.—An experiment made with a drying-room containing 50 frames, each 6 square feet, showed the cost of drying 30 pounds of apples, for help, at 6 kr., and 30 pounds of pears, at 9 kr. 120 pounds of apples required a space of 12 square feet; the same weight of pears required 18 square feet; it required 1 pound of wood to evaporate 1.65 pounds of water; 40 pounds of pears lost 32 pounds of water; the drying of this fruit required 20 pounds of wood, at 6 kr. A bushel of dried fruit would cost, if a bushel of green fruit cost 30 kr.:

1. 4 bushels of fruit, at 30 kr.	2 fl. — kr.
2. Expenditure of wood	" 36 "
3. Hired help	" 12 "
4. Expense for peeling	" 48 "
5. Loss of the peeling	" 12 "
One bushel of dried fruit	3 fl. 48 kr.

A bushel of dried peeled apples, weight 19 pounds 2 ounces.
" " " pears, " 27 pounds.
" not peeled " 29 pounds 8 ounces.

The worth of the dried fruit is,

a. 1 pound dried pears, not peeled	8 kr.
b. 1 " " " peeled	11 "
c. 1 " " apples of good quality	14 "

Per hundred, *a.* 13 fl. 20 kr.; *b.* 18 fl. 20 kr.; *c.* 23 fl. 20 kr.

Prunes.—One bushel of dried plums cost 40 kr. for fire-wood; hired help for drying, 15 kr. 3½ to 4 bushels of fresh plums produce one bushel of dried fruit, which will weigh from 33 to 35 pounds. One bushel of fresh plums require 30 square feet space in the drying-room. The average price of one bushel of fresh or green plums is 30 kr.; so one bushel of dried fruit costs:

1. 3½ bushels fresh plums, at 30 kr.	1 fl. 45 kr.
2. Fuel	45 "
3. Hired help	15 "
4. Refuse	10 "
5. Interest of capital invested	10 "
	3 florins.
The retail price of 33 pounds, or one bushel, is	4 fl. 24 kr.
Net	1 fl. 24 kr.

When pears boil considerably in their own steam at the commencement of drying, they will be of a beautiful red when cooked. If they are required to be transparent on the table, they are not so much steamed at the commencement, and are allowed to cool quickly when taken out of the drying-room.

APPENDIX G.

THE CULTURE OF THE SILK-WORM.

EXTRACTED FROM THE WORK OF ANTON ZIEGLER, INSPECTOR AND DIRECTOR OF THE MULBERRY CULTURE AND SILK-WORM BREEDING IN BAVARIA.

APPENDIX G.

A. ZIEGLER ON THE CULTURE OF THE SILK-WORM.

Introductory Note on Silk Culture in California.—Advantages of the Culture of the Silk-worm.—The Breeding of the Caterpillars.—The Breeding-room.—The Eggs and their Development.—The Food and Feeding of the Caterpillars.—The different Periods in the Life of the Silk-worm.—Air, Light, Warmth, and Space.—Cleaning the Crates.—Putting up the Spinning-bushes.—Diseases of the Silk-worm.—Enemies of the Silk-worm.—Propagation of the Caterpillar, and obtaining the Eggs.—Taking off and assorting the Cocoons.—Killing the Cocoons.—Converting the Cocoons into Money.—Winding and Winding Establishments.—The Floret Silk.—The Magnaries.

Introductory Note.

Silk Culture in California.—This important branch of agriculture, which makes every province where it is cultivated prosperous and even wealthy, I have thoroughly examined, and, after comparing the circumstances governing the culture of the mulberry-trees, breeding the silk-worms, and manufacturing silk, I am thoroughly convinced that California possesses more advantages for this culture than any other country which I have visited. Many of my readers will at once condemn this statement on account of the high price of labor, but this charge I refute by the fact that in Europe the high tax on mulberry-trees and land, the very high price of the land itself, will more than counterbalance the higher price of labor here, where Chinamen—eminently fit for this purpose—could be got for a trifle. Then, again, in Europe the tree grows from five to six years in the nurseries; then planted in the field; when so planted it takes two years more before it will furnish more than a few pounds of leaves; in fact, a tree must be at least twelve years old that gives a good revenue. This is not the case in California. One year in the nursery, then planted in the field, will give, when four years old, more leaves than the mulberry-tree in Europe. Sum up the high taxes on land and trees, the valuation of the land and the interest on it; the culture of the young trees, all for eight years more than here, and your high price for labor will diminish almost to nothing, and far below the price of labor in Europe. Then, again, the all-important fact that in California the silk-worm can be raised in the open air—at all events, in open sheds, covered at the top, if you please, with corn-stalks, or even straw piled on rails—while in Europe costly stone or brick buildings have to be raised, with thermometers hanging in them, and even with this precaution a thunder-storm will often destroy the whole brood, losing labor and expense, and, in fact, the season, as the trees will not, contrary to nature, bring forth new leaves; but, if the breeder escapes this calamity, the extra care and labor he has to take for cleaning and airing his delicate worms is as much more expensive as raising oranges and grapes in a hot-house to that of the open air. As we have no thunder-storms, we could raise the worm on the tree itself, were it not for the birds destroying them. They can be raised here, without doubt, under sheds, and what farmer is so poor who could not make a shed of posts and rails, and cover it with canvas or straw?

I have given reasons enough in the above lines to convince reasonable minds that the difference in the price of labor between here and Europe will be counterbalanced by the taxes mentioned, the costly buildings, high price of lands, etc., etc. But, for argument's sake, admit that, on a large scale, with high labor, silk-raising would not be profitable, would this be a good and sufficient argument to throw this enterprise overboard? I say no. It is a well-established fact in California, as well as in the Western States, that no farming operation, on a large scale, with high labor, can be carried on successfully. Every man who attempted it failed, and was ruined.

Would any person advise, therefore, to abandon farming in the United States, as a business which will not pay, and advocate the importation of seed and breadstuffs from foreign countries? I suppose that no man would like to appear before the public with such a ridiculous proposition or argument.

So it is with silk-raising, as I will demonstrate. Almost every farmer's wife will raise chickens, turkeys, ducks, or geese; this is considered a recreation, and with pleasure and pride does the industrious and good housewife call together her feathered subjects, showing to her husband and neighbors the little treasure she has created by her industry. I call it treasure, for many a shilling is saved from the hard earnings of her husband for the purchase of sugar, tea, coffee, and often dresses, by the sale of eggs, chickens, turkeys, etc., etc.

Now, then, to raise chickens, etc., it requires the care of a whole year; when raising silk-worms, twenty-four to forty days will be amply sufficient time bestowed on them; and, again, it is much easier to raise silk-worms than poultry. Every farmer's wife can raise the silk-worm successfully without the least difficulty; it is so very simple that every body can comprehend it by reading the mode which I will give below.

I do not for a moment advance the idea of discontinuing the raising of poultry. No; the housewife can raise poultry and breed silk-worms; they do not interfere with each other any more than her husband's raising wheat and potatoes on the farm.

This will be, too, an additional income to the good wife, and a much larger and surer one, there being no fluctuations of importance in the price of cocoons, the price being fixed according to quality, Nos. 1, 2, and 3; not, like poultry, sometimes not to be sold at any price, or, if not for cash, for some unnecessary trash in the store. Cocoons are in all countries *cash*, and I warrant that it will be so in California. But I see my fair reader's inquiring looks for the lines containing the probable profits of such an undertaking. I will give an approximate estimate from data collected on my travels and from celebrated authors. I will here suppose that California will give no more encouragement than the least favored country in Europe—Bavaria. I have taken this northern country as an estimate to be far below the real result which must ensue in California, as I am satisfied that this state is better than the best in Europe for cultivating the mulberry. Bavaria, in its produce of leaves to the tree, is 50 per cent. less than the south of France or Italy. A farmer possessing 40 acres of land can divide his land in convenient lots, surrounding each lot with a double row of trees; this will be no detriment to his crops or farm, but will serve to beautify his property very much. If the farmer has means to purchase mulberry-trees from the nurseries, it will be to his interest, as he will gain a year; if not, he may purchase 50 cents worth of mulberry seed, sow them in a bed, and raise his own trees. When one year old, plant the trees in avenues 12 feet apart; 300 trees, 4 years old from planting, will give 10,000 pounds of leaves. This produces 125,000 cocoons, which, at 90 cents per thousand, is $112 50. This sum one housewife with a child ten years of age, without extra help, can save by 40 days' care at the utmost. The price here is estimated as in Germany, so 40 per cent. may be safely added. This income will be almost doubled every year, until the tree reaches its highest bearing, which is about its twenty-fifth year, when, in California, no doubt 400 pounds of leaves will be the yield.

When the happy event occurs that the family increases and grows with the trees, then those little creatures will lighten the labor of their parent, even in their tender years; for children eight years of age, for rearing and feeding silk-worms, are quite as useful as older ones. The work is more play than any thing else, and therefore not detrimental to health.

Where trees are producing more leaves than the housewife and her family can attend, it would be proper to lease such trees to women who have none of their own—to wives of mechanics, tradesmen, etc. In Europe, wherever silk-worms are bred, every body has them—wives of officers, tradesmen, merchants, etc. Nobody thinks it below their dignity to raise them; so far from it, that ladies enter into competition as to who can raise the finest cocoons, and the greatest number, from a certain number of leaves.

Reader, do you not think that something should be done to enable poor but honest females to earn a living honorably? Not every female is fit to make a housemaid. Some have been so unfortunate in life as to have been brought up delicately. This class, even if pride should not prevent them from living out as kitchen-maids, have not strength, are delicate, and would soon compel their employers to discharge

them. But the occupation of rearing silk-worms would enable females to earn sufficient to live for at least half of the year, if not the whole. This is done by many in Europe, and can be done here.

The culture of the mulberry and the rearing of the silk-worm I would not limit to California, but extend it all over the United States where the trees do not freeze; but, of course, they can not compete with California, as they have the same difficulties to contend against as the European breeders; but they have the very same chances as the Europeans, without the high taxation, or tariff on silks, which sets them far ahead of their European rivals. I am well aware that I handle a subject which, some twenty-six years ago, exploded as a great humbug, and has been a subject of ridicule with every one since, and whenever an enterprise seems to receive general attention, persons are reminded of the *morus multicaulis humbug;* but I will not shrink from advocating a measure which I have carried on in my native country, Hungary, with great success, and which, in my recent travels, after the closest examinations, I have found profitable every where the tree is planted and can live.

I am not familiar with the exact reason of the failure of the *morus multicaulis* in 1835 and 1836, but believe it was owing partly to the great money crisis which just then depressed the whole country, and partly that every one planted the seeds in nurseries for sale, and none for going into the business themselves; or, as is often the case with our people, they all started to get rich in one year. No merchant should be frightened when his neighbor fails; he should rather examine thoroughly the cause of the failure, so that he may avoid falling into the same error; for it is well known that some merchants make money, and that commerce, if laid out by certain rules, will make the person following it prosperous; so with the mulberry, if we do not overdo it; if we remain in a reasonable boundary, millions will be added from this source to the income of our country.

There are before me, in many languages, elaborate reports to different governments, lengthy treatises, books, etc., on the culture of the mulberry and breeding of the silk-worm, which to treat thoroughly would make this article too voluminous, therefore I will give only a short extract from them, more especially from the report of ANTON ZIEGLER, *Inspector and Director of the Mulberry Culture and Silk-worm Breeding of the Kingdom of Bavaria.* A. H.

Advantages of the Culture of the Silk-worm.

Instead of giving a lengthy introduction, let us at once proceed to our subject by annexing a comparison and calculation of the costs and proceeds of a mulberry plantation:

Suppose we take one "*tagwerk*" (parcel of land), suitable for a plantation—say, for instance, a hill-side, protected from high north winds (as we do not wish to rob the grain agriculture of its more fertile fields, not absolutely required by the mulberry). The net proceeds of this same piece of ground, by producing grain or other cereals, would amount to about 10 florins (1 florin=40 cents.); bearing mulberry-trees instead of these, it would, however, result in a much larger gain. For let it be about 200 feet long and 200 feet broad, furrowed by 21 rows of 9 *grown-up trees* each, planted 24 feet apart from each other, and the rows 9 feet, and we shall have 189 trees altogether.

In the intervals we may have *shrubs* (young trees) of the same kind from 6 to 6½ feet distant; in 21 rows, therefore, 504 (allowing 10 of them to 1 grown tree). This will give us 249 of the latter in the entire plantation.

Suppose, now, they have been transplanted to their particular spot when 6 years old, and their produce will result as the an-

nexed table shows, according to manifold experience, allowing, at the same time, the highest figure for all expenses and the lowest for their produce, and remembering that an industrious man may save the most of the former by the aid of his family:

The Year of Planting.	Age.	Produce of Leaves after v. Turk.		On these live Caterpillars 16 to 1 Pound of Leaves.	From these may be gained Cocoons.	To the Value of 600 of them at one Florin.		Expenses.											After deducting the Costs, remain,			
		Of a single Tree.	Of all Trees.					Cost of the Planting	Cost of Replanting.	Cost of maintaining the Plantation.	Cost of Manure.	Wages for raising Caterpillars. Wages for one Person at 15 krs. a day.		Wages for a Man at 24 krs. a day.		For Crates.	Total.		Net Proceeds.		Deficit.	
		lbs.	lbs.	pieces.	pieces.	flor.	kr.	flor.	flor.	flor.	flor.	flor.	kr.	flor.	kr.	flor.	flor.	kr.	flor.	kr.	flor.	kr.
1	7							28									28				28	
2	8	2	498	7,968	5,976	9	57		2	25		10	30			10	47	30			37	33
3	9	4	996	15,936	11,952	19	55		2	25		10	30			10	47	30			27	35
4	10	8	1,992	31,872	23,904	39	50		2	25	20	10	30			20	77	30			37	40
5	11	16	3,984	63,744	47,808	79	40		2	25		15	45			20	62	45	16	55		
6	12	32	7,968	127,488	95,616	159	21		2	25		26	15	16	48	20	90	3	69	18		
7	13	64	15,936	254,976	191,232	318	43		2	25	20	52	30	33	36	30	163	6	155	37		
10	16	80	19,920	318,720	239,040	398	24		2	25		68	15	50	24	30	175	39	222	45		
15	21	120	29,880	478,080	358,560	597	36		2	25		99	45	67	12	30	223	57	373	39		
20	26	160	39,840	637,440	478,080	796	48		2	25	20	136	30	100	48	40	324	18	472	30		
25	31	200	49,800	796,800	597,600	996			2	25		168		134	24	40	369	24	626	36		
						3416	14										1609	42	1937	20	130	48

In the foregoing calculation we have purposely omitted the increasing value of the timber and fruits, as well as seeds of the trees. What other culture could be able to show such lasting and geometrically increasing gains? If each farm and hamlet only would dedicate 3 "tagwerks" to the culture of the silkworm, it might result in an increase of several millions to the home production, and consequently to the national riches.

In order to show the case even in its most minute relation, let us suppose that a father plants, at the birth of his child, a 6-years-

old mulberry-tree, and takes care of it till it gets to be 16 years of age. Our table shows us that a tree of 16 years produces 80 lbs. of leaves; these give food to 1280 caterpillars, which give about 960 cocoons, and these represent a capital of 40 florins (600 cocoons = 1 florin). If this same tree is taken care of for 15 years more, it will bear 200 lbs. of leaves, and feeds 3206 caterpillars, promising a yearly income of 4 florins = a capital of 100 florins. This should induce, in fact, every farmer to plant a certain space of his land, at least, with mulberry-trees, and, wherever it be convenient, to line his fields with hedges of them.

The Breeding of the Caterpillars.

This begins when the plantation has attained such an age that a corresponding quantity of leaves may be relied upon. Prudence, however, requires us to make the first trial with only a limited number, in order to instruct one's self in all the minute cares and details that are required by the business, which may be better learned in this way than by at once undertaking it on a larger scale. This exact knowledge, only to be obtained by several years' close attendance, will be found the more necessary, as without it a too large expense might easily be incurred for eggs by overcalculating the quantity of feeding material, which might bring the silk-worm raiser into serious trouble, as he would be forced, by the want of the latter perhaps a few days before the time of spinning arrives, to sacrifice the majority of his caterpillars in order to save at least the remaining few. In this way time, trouble, and leaves have been frequently sacrificed in vain.

The breeding of the caterpillars requires a certain amount of care and attendance, although the insect may not perish by every sudden change of temperature or small want of the former. To know how much they may be able to stand, cover one of the trees at the time of breeding with a fish-net, to keep the birds off, and let a part of the caterpillars creep out on the twigs. Those falling off must be picked up and put back to them.

The Breeding-room.

This requires, above all, a sunny, dry site, which must be high, not exposed to the influence of bad odors, and have a contrivance to be warmed. If convenient, it is better situated in the second story of a house than on the first. Care must be taken to soften the too bright sunshine by window-curtains, and to prevent mice, spiders, etc., from getting into it. For the beginner, any such conditioned room will do in which he may raise a few thousand caterpillars on crates or other fixtures that he may even place upon a table. A gradually increasing breeding requires, of course, a proportionately larger room, and a certain rule in all its necessary arrangements. Scaffolds will then be required of the following description: According to the locality, posts are put up (inside

the room), about 5 feet distant, on a straight line, and $2\frac{1}{2}$ feet behind one another, from the floor to the ceiling high, some feet off from the windows. These are connected by a cross lath 2 feet apart, so that those nearest to the floor, as well as those to the ceiling, are separated also by 2 feet distance from it, in a manner that they may serve, at the same time, as support to the crates or mats (later to be described). In case more than one such stage is made, care must be taken to leave sufficient room between them to allow a ladder to be moved about, serving the attendant to put the feed upon the upper rows.

The feed-boxes or crates, whose shape corresponds to that of the stage, so that they may be easily taken out and put in again, are formed by a frame of laths 2 to 4 inches wide, and of willow or cane wicker-work. They may be made, however, of whatever material happens to be nearest at hand and cheapest—water-reeds, plank-shavings, etc., etc. For cleaning them out, it will be found convenient to have them all of the same size, so as to fit in all parts of the stages.

The Eggs and their Development.

To get good eggs must be a chief object, whether from one's own breed, or from other well-reputed plantations if preferable. This latter will be found best until some years' experience has taught the art of breeding for one's self; and even then it might be good policy to exchange from time to time with other breeders, as it will lead to the improvement of the stock. A negligence in this may often produce great disappointments and losses. The most reliable sign of good eggs is a light-gray color. Crushed upon a finger-nail, they must crack and emit a tough, cloudy liquid. But only the very creeping out of the young caterpillars is convincing proof. If healthy, these have a reddish-brown color and black head; if sickly, they appear red or black.

A careful breeder will finish all his arrangements at the proper time, *i. e.*, in the winter months. He will put the eggs into a clean, but not air-tight vessel, about three times the size as required by the quantity of eggs, and hang them up in a cool dry place (especially good cellars), in such a way that no mice can get at them. They may also be put upon paper or linen, and this slightly rolled up. From three to four weeks they need looking after, and a free access of air while they remain locked up. Those upon paper, also, must from time to time be rolled the other way. In the winter it is well to expose them to the dry cold, for it is known that even the most severe cold will not kill them, but will be of benefit. Many breeders, for this reason, leave them in the open air, only protecting them from the snow. At the coming of spring they are taken to cool places, however, until they creep out.

When the bŭds of the bushes and mulberry hedges begin to appear, the worms must be taken out of the vessel, and put (in par-

cels of two ounces), in low pasteboard boxes, into the *not warmed* room destined for their breeding. After leaving them so for five or six days, one may begin to heat it, and to increase the temperature of the room, by adding 1° each day, to 16° or 20° R. This must now be kept up day and night, but never above 20°, until the development of the caterpillars takes place. Shaking the eggs lightly every day, the light-gray color will disappear more and more, and, after a few days, the first young caterpillars will make their appearance. Now the heat in the room is to be increased by two degrees, and, within three days at most, all the other eggs will open to let the insects out.

As soon as the first ones show themselves, the eggs must be covered by a piece of gauze, and thin twigs of the mulberry-tree strewn over them, to which the young caterpillars will immediately seek to creep. When a sufficient quantity of these is collected upon them, they are transferred to the paper-covered crates by the aid of a pair of small pincers, and arranged in such a way, leaving small intervals, that at each succeeding addition a little more space may be allotted. The gauze must fit exactly into the box, and cover lightly all the eggs. Places where the young caterpillars lie too thick upon one another have to be covered by tender leaves, and the insects creeping on these transferred to another one.

The caterpillars are carefully assorted according to their age, so that, for instance, those which crept out in the morning are not placed together with such as come out in the evening, or those of to-day not with those of the preceding day. After three or four days the creeping out must cease; all those that have not come out are not farther to be considered. If the breeding comprises more than one ounce of eggs, it is advisable not to lay them out all at once, but at intervals of several days, thus preventing all the caterpillars from becoming ripe enough to spin at the same time. Each separate parcel may be called *a breed.* In this way five or six of them may be produced in the same year.

The Food of the Caterpillars.

The smaller the quantity of food given to them, but the oftener a day, the more it will benefit them. About seven or eight times within 24 hours would therefore be the best policy, and of these, the *main meals*, in the morning, at 4 to 5 and 10 to 11 o'clock; in the afternoon, at 4 to 5; and at night, at 10 to 11; the intervening meals being given after 7 A.M., 2 P.M., and 8 P.M. At 11 o'clock P.M. a larger quantity of leaves may be given, and stopped during the balance of the night, while the caterpillars have not yet shed their skin for the last time. When this, however, has been done, they become much more voracious, and must now be fed even during the night.

In the beginning the caterpillars require only very tender

leaves; when growing, they want stronger ones; and before their spinning, the stoutest. Before the time of the third shedding of the skin, the food has to be cut finely with a sharp knife; during their growing, with a two-edged blade, thicker and thicker. This must be done immediately before the meal-time, because otherwise the juice would dry up and the leaves would wither.

After the third shedding of the mandibles, the animals have attained sufficient strength to chew the whole leaves for themselves. These are better collected early in the morning, after the dew has dried off, or in the evening, before it begins to wet them; during the heat of the day is not advisable. In case of rainy weather menacing, it is necessary to provide a sufficient quantity to last for a few days. If, however, it has been unavoidable to cut the leaves during a rain, they must be dried before feeding them. If left on the twigs in an airy place, they dry quicker than if broke off.

Wet food makes the caterpillar apt to sicken; it is considered safer, therefore, to let them rather hunger a short time than allow them to eat it. Leaves that have dust on them do no harm; but such as have mildew settled upon them must be washed off and dried again. Do not feed the leaves right fresh from the tree or the cellar; but let them, in the first case, evaporate for several hours; in the latter, at least half an hour. For the gathering of the leaves clean sacks or baskets must be used, into which the twigs must, however, never be pressed. Immediately after, these must be taken to a cool place, and protected from the sunshine and air-draught.

About the quantity of leaves to be given there is no certain rule. Experience has shown that the caterpillars out of one ounce of eggs eat up about 800 pounds of leaves in the manner that the first half is allowed until the fourth, the last after the fourth shedding of the skin takes place. According to this estimate, counting 12,000 to 15,000 caterpillars to one ounce of eggs, one single one would consume during its existence about $1\frac{1}{2}$ to 2 ounces of leaves.

The different Periods in the Life of the Silk-worm.

The total term of its life comprises not more than 24 to 36, or, at the utmost, 42 days, and depends partly on the higher or lower state of temperature in which it lives, on the care it enjoys, and the quality of the food.

Its nature forces it to shed its skin at different times. This period is also called the *sleep* of the caterpillars, because then they will remain perfectly unmoved upon their place, without partaking of any nourishment at all. While in this state they must not be fed, nor touched, or troubled; and if some wake up sooner than the rest, it is better not to feed them till all are alive again.

The shedding process itself is very interesting. At the head of the caterpillar, which appears very much swollen, a kind of

mask is formed. This is gradually removed, and the insect creeps, not without some exertion, out from its old skin, that is glued fast to a twig somewhere about the hindmost feet. The shedding usually takes place four times; the exceptional cases, however, only three times. The closest attention has to be paid by the silk-worm breeder to the equal setting in of this process. Each breed has therefore to be carefully separated at the moment of the creeping out of the caterpillars, and all the insects must enjoy an equal share of leaves, of sufficient room, and warmth.

With proper care and treatment, the sheddings will take place in the following intervals: 1st, on the 5th day of the age of the caterpillar; 2d, on the 9th; 3d, on the 15th; 4th, on the 22d. On the 32d day of its life it begins to spin. The term of a shedding is usually from two to three days, and shows itself by an increased appetite the day previous, which must be satisfied by sufficient food. At each renewed process the color of the head of the worm gets lighter.

After it is over the worms must be fed on twigs spread over them. At the same time, they are transferred to the other parts of the crates by putting the twigs to which they cling upon them, and the regular feeding is continued.

At each shedding, occasion must be taken to classify them according to their size—this producing a better equality in their functions, and, finally, in their maturity.

Special signs of a well-performed shedding are a lively appetite, quietly remaining in their places, and increasing size of the body. On the contrary, a restless running about on their crates or their margins indicates always, if maturity has not been attained yet, a sickly state of the worms. These, as well as those that have not strength enough to strip their skins entirely off, must be taken out.

Air, Light, and Warmth.

Pure air, a warmth regulated to what we shall see hereafter, are, besides the regular feeding, the main points in breeding silk-worms. The atmosphere made impure in the room by the evaporation of the worms, the leaves, the manure, or other influences, must be removed as soon as possible by frequent airing, taking care, however, that no humid air enters from outside, as well as no strong draught. Especially is this necessary in the latter stage of the life of the worms, and, above all, shortly before and during the spinning-time.

Fresh bunches of *wermuth* (sage) are very good for improving the air, being suspended on the windows; also roses put in the room form an agreeable aroma to the worms. In case the exterior air has the same degree as that inside, it is better not to let it enter. Quick-burning fire of dry straw, or vessels with freshly-burned lime placed upon the floor, improve the air. Kitchen salt

on a plate may serve very well as a sign whether the inclosed air needs improving by its getting humid. The direct influence of the sun's rays is very detrimental to the worms; it must be moderated by window-curtains made of paper or linen. In regard to the warmth of the room, it must be borne in mind that the worm, from its first moment of existence to its spinning in, requires a gradual reducing of it; so that if it needs 22° R. at the time of its creeping out, it only wants 18° at the spinning in.

In order to let them properly thrive, it needs that in life they are not too much pressed together. For those from one ounce of eggs the following spaces are considered sufficient: At their first period, 5 square feet; second, 10; third, 23; fourth, 55; fifth, 120. If the previously-mentioned crates hold about 12 square feet, about 10 of them would suffice for the worms derived from 1 ounce of eggs.

Cleaning of the Crates.

Cleanliness is half the food. Would the breeder keep his worms in good health, he must remove in time the waste of the leaves, and the easily fermenting manure. This is done in the following manner:

The caterpillars are cleaned for the first time by small twigs strewn over them at their first shedding of the skin. The animals, collecting thereon, are transferred to clean places by means of small pincers, and then fed. After one brood is taken off, the act of covering and transferring is repeated over again, until all have been cared for. The remaining portions of food and manure are removed on the following day, when sure that no worms are forgotten. The same manner of proceeding is adopted after the second and third shedding. After the fourth, it is repeated every second day. Persons perspiring freely at their hands are not fit to do this important business.

The taking off of the worms must be attended with great care, as the tender animals are otherwise very easily hurt. The best way is to take hold of them close to their head without pressing, and to loosen them tenderly from the place they stick on.

A newer and very excellent method is the following: After the third shedding, spread over them a net with meshes wide enough to allow the worms freely to pass through (the nets having the width and length of the crates). They will soon creep through and upon it. The nets are now fastened to several small sticks provided with hooks, to the right and left of the crates, lifted up by means of these, and hung upon nails driven into the posts for this purpose. Now the crates can be cleaned off, and the worms, with the net, let down upon them. In this simple manner the cleaning of many crates and worms may be done in a very short time. Care has to be taken that the dirt and dust of the upper tier of crates does not fall upon those below.

The putting up the Spinning-bushes.

After the third shedding process is passed, it is well to commence putting up the bushes needed by the worms to spin their cocoons on. These may either be placed on separate stages or scaffolds of boards, or on the crates. In both cases they consist of twigs of trees that have neither thorns, nor prickles, nor resin; if possible, of birch. The twigs must be free of leaves, perfectly dry, and without any smell.

In constructing the arrangement, the upper crate has always to serve as cover for the bushes beneath it. Thin laths, not quite as long as the breadth of the crates, are then taken, having small holes bored through them, one inch apart, to let the bushes in. These must be about half an inch longer than the distance from one crate to another. Bushes tied from small twigs can also be used without these laths; care has then only to be taken that they are not placed too close together, as in that case the free air has not the necessary access. The worms will also sometimes use paper bags and other hollow things for spinning places. To prevent the falling off of the caterpillars, all twigs extending over the scaffold must be cut off.

The Worm when ready to spin itself in.

This may be known by the following signs:

1. It refuses food—even avoids it; creeps about in troubled haste, with head erect, especially on the frame of the crate, as if hunting for a suitable place.
2. A thin thread of silk protrudes from its mouth.
3. The skin of its neck gets wrinkles.
4. Held against the light, the body appears transparent, and feels soft.
5. The worm, when taken from its place, tries to wind itself around the finger.

When remarking these signs, it is time to bring them to their spinning places, as they would otherwise lose too much silk, get lazy, and either spin very little or not at all. The right moment must be found out. If left too long on the twigs, the worm may fix its cocoon either on the sides or corners of the crate, and thereby molest the others. If taken off too soon, it is prevented from feeding just at a time when it needs the most nourishment. Immediately before the spinning in, the worms discharge all the excrements that yet remain in their body. If too many are put on the bushes at a time, they will hinder one another in spinning, or two of them may spin their cocoons in one; these not being very valuable. Smooth wooden plates are used for transferring them, and they are distributed, beginning from the uppermost row along the sides of the bushes.

If the first breed has already spun their cocoons, fresh worms

must be transferred during three or four days until nearly all the space is taken up. Some worms will return from the bushes to their food; it is therefore advisable to distribute good juicy leaves in such a way that they may easily reach them. Those that have not begun to spin on the bushes after two or three days are best taken out into the open air for a few minutes, and then placed upon other branches mixed up with paper bags, wood shavings, etc. By covering them up with paper or linen, they will now soon be seen spinning. During this work all unnecessary troubling or shaking them must be avoided. If the weather be fair—when the free access of air and sunshine is very advantageous to the worms—they will finish their cocoons within four days.

Diseases of the Silk-worm.

The so-called *Green Pip* is one of their most common and dangerous diseases. Its signs are, the swelling of the head, a yellowish color spreading over the whole body, and a yellow moisture ejected by the worm. It begins ordinarily to show itself not before the fourth spinning period is over, and is partly attributable to a sudden change of temperature or a too crowded space.

Another still more dangerous disease is the so-called *Calcino* or *Muscardine.* The worms appear as if covered with a coat of lime, and must be taken off directly, as they will infect others.

When the excrements of the worms are found to be more moist than dry, it will be well to feed leaves of older trees, and stop giving those of bushes or hedges. Dead caterpillars are always to be instantly removed, and crates upon which sick ones have been lying can only be used again after a careful cleaning.

Enemies of the Silk-worm.

Of these are indeed many, always making the breeding in the open air troublesome, or even impossible. Among them are ants, spiders, wasps, mice, chickens, cats, and nearly all carnivorous birds. All of these must be carefully excluded from the breeding-room.

Propagation of the Caterpillar, and obtaining the Eggs.

After the cocoon has been spun, and the worm inside of it transformed itself into a "nymph," this will fifteen or twenty days later become a butterfly, which opens the cocoon by means of a caustic and softening moisture. This it performs generally in the early hours of the morning. The male is recognized by the peculiar vivacity with which he runs about, by his smaller body, and the larger dark brown feelers. The female has a bigger body, and is generally quiet, at least moves very slowly. Both do not fly, as their wings are as yet too short.

As soon as the butterflies have attained their perfect form and ejected a yellow or reddish moisture, their pairing is accelerated

by putting the females upon the crates about one foot distant from each other, and the males coupled to them. The most experienced breeders consider six hours sufficient for the act of pairing to produce good eggs. Some advise to separate them by force; but this ought not to be done except in case more females than males should have crept out, or if the act lasts longer than from morning till evening. If it be necessary, they must be separated with great care by taking hold of their wings. In case they separate by themselves before the proper time, they must immediately be reunited. If there are more males than wanted, they must be kept in a perforated box, to be used on the following day.

The female, soon after impregnation, will begin to lay eggs. For this purpose, a frame with cotton or woolen stuff tightly stretched over it has to be placed in a slanting direction against the wall, and the female placed upon it. Slowly crawling upward on this, she will have finished depositing the eggs in 24 to 48 hours. Now she is to be taken off, because the eggs which come later are generally of no account. Those laid within the first 24 hours are the best. The butterflies close their life soon after having fulfilled their earthly destination. The breeding-room itself must be kept somewhat dark during their pairing and laying.

The freshly-laid eggs are of a yellow color, but from day to day they grow darker, until, after about three weeks, they appear ash-gray. In order to loosen them from their places, on a warm winter day moisten the cotton in a vessel filled with fresh water, and rub the eggs softly with the fingers. They sink to the bottom, and are dried in the sun after pouring off the water.

The persons who breed silk-worms must keep themselves very cleanly, and never attend them without previously washing their hands. Sick persons, especially those who have fevers, must never do it; they must not even enter the breeding-room. Such as incline to perspire freely must neither gather leaves nor feed the caterpillars. Smoking is not allowed in the breeding-room, and in using a snuff-box great care is to be taken that no tobacco-dust may fall upon the worms or their places.

Taking off and Assorting the Cocoons.

The cocoons must not be taken off before the ninth day. Their perfection is indicated by a rattling of the chrysalis when shaken. The assorting has to be performed at the same time, and the selection of the breed-cocoons. This occupation requires great care, because the value and quality of the eggs depend on it. The whole crop may be divided into five classes:

1. *Breed Cocoons.*—Those of the strongest texture, surrounded by a rich quantity of flock silk, of a regular shape, must be picked out, and especially those that were among the first spinners, and show a white color. Their being taken off and freed of the flock silk has to be performed with the utmost care. They are

then spread over the crates in a temperate room, and the breaking through of the butterflies waited for. The sexes can not be distinguished with certainty. It may therefore be well to select an equal number of a round and oblong shape, as the first are generally believed to contain males, while the others contain females.

2. After selecting the "breed-cocoons," all those very *strong and rich in silk*, like the first day.

3. Those of *medium quality*.

4. All of a *weak and imperfect texture*.

5. The *double cocoons*, distinguished by their larger size and coarser texture.

The breed-bushes must be carefully handled for assorting; the cocoons placed very tenderly into the baskets destined to receive them, in order to avoid the bursting of the chrysalis and its soiling the cocoon.

Killing the Cocoons.

When assorted, the nymphs must be killed to prevent their gnawing through and spoiling the silk for the purpose of unwinding it. It may be done in two ways:

1. *By dry heat* in the bake-oven. The cocoons are to this end put into low wicker-baskets, and placed in the oven, at a temperature of 30° to 35° R., upon bricks previously arranged. In consequence of the heat, a noise of the suffocating nymphs will be heard. Half an hour later, all is over and the business done.

2. *By steam.* A kettle filled two third parts with water is placed upon the fire until it boils. Upon it, so as to fit its size, a sieve filled with cocoons is placed, and this covered over with wet clothes to prevent the steam from escaping except through it. To see whether all life is extinct, after about a quarter of an hour take some of the cocoons and press them between the fingers. The movement of the nymph will show if it is not dead. If put in an airy place, the cocoons will soon recover their prior elasticity.

As mistakes in the management of this business might damage the article, the greatest care must be taken neither to increase the heat in the oven too much, nor to expose the nymphs to bursting by keeping the sieve too long over the kettle.

Not very strong cocoons are better suited for the first manner; those, however, whose nymph rattles for the latter.

Converting the Cocoons into Money.

To do this as soon as possible, and to the best advantage, must be the chief object of the breeder. Waiting too long exposes him to a twofold danger:

1. Of the biting through of the butterflies if not killed; and,

2. Of losing in weight and value by the drying in.

To realize the money value, therefore, may also be effected in a twofold way:

1. By reeling off the silk with one's own hands, and occasionally selling it; or,

2. By selling the cocoons to a reeling establishment for a price adapted to the quality of them.

The price obtained for cocoons varies with the crop. In Germany the average price per pound is as follows, the florin containing 60 kreutzers, being worth 40 cents:

For perfectly dried, strong cocoons	1 fl.
For the second quality	48 kr.
For double cocoons	30 "

The unwinding requires an expertness only to be obtained by a practice of several years, and makes expenses necessary that might prove not very advantageous to a single breeder. The sale of the cocoons to those establishments may therefore be preferable. In Italy, for instance, it is the general custom with the farmers.

In case they are to be sent off some distance, they must be carefully packed in baskets or boxes, neither pressed in nor put up too high. At the bottom of the barrel or box is for this purpose placed some soft paper; upon this, one hand high, the cocoons; upon these, again, paper, and another layer of cocoons. When arrived at their place of destination, they must be directly taken out, spread out in an airy place, and protected from insects and animals.

Winding, and Reeling Establishments.

The occupation of unwinding the cocoons may safely be considered the chief one of the silk culture. An experienced person will produce valuable silk even from middling and bad cocoons, while one not expert damages the best, or obtains a silk hardly salable. Practice only can teach the necessary manipulations and operations required by this seemingly very simple business, of which we will here only speak in general outlines. In Italy females are usually employed in this occupation; and five years are generally allowed as the term necessary to make a person expert in it; and the product of a known hand is always sold at a higher price than that of one less so.

In order to unwind the cocoons and unite their threads into one, they are put into a kettle filled with hot water, 15 or 20 at a time. The water must be kept up to a nearly boiling point. When the adhesive substance which surrounds the web is sufficiently softened, the person hunts up the end of the thread by brushing the cocoons lightly with a small broom made of rice-straw. The threads attach themselves to the points of it. If more than the above number of cocoons be taken, or if they are brushed too roughly, the threads may become entangled, and too much of the web may be lost. The person takes those threads in the right hand, and endeavors to obtain successively all of them clear

by continually waving them to and fro, and stretching. After this they are given over to the left hand.

Now the operation begins of winding them on a reel. According to the stronger or finer quality wanted, 5, 6, 7, frequently even 10 or 12, and more, such natural threads are spun together into one. Of such, two are formed and drawn through a piece of tin, pierced by small round holes, that is fixed above the kettle. From here they are conducted, by means of wire-pins with eyes, or a glass fixture, to the "*reel*," after being crossed or twisted a little. An equal thickness and strength is the main consideration in a thread, and is only to be effected by a strict attention paid upon all of the cocoons in the water. At the beginning, as well as at the end, each thread tapers off a little; a new one must, therefore, be added at the right time.

The closest attention has to be given to the cocoons in the kettle by the person in charge of the work, and as soon as the thread of one is found broken, it must be replaced by another one. It will not do to wait until the cocoon has entirely run off; but the rest of it, formed of a thin skin, must be taken out in time, preventing its juncture to the thread, and thereby spoiling it; but this must not be done too soon, because too much of the valuable silk would be lost.

At the operator's right side a vessel with cold water is placed, to cool the fingers from time to time. This water must be river or rain water. If well water can not be avoided, it has previously to be exposed for several days to the influence of the sun to make it soft.

The unwinding of the cocoons begins soon after the assorting is gone through. The room in which it is done must be bright, airy, and spacious. It is best to perform the operation in the open air under a shed; but the day must be fine, as rainy weather makes the silk not dry well, and lose its lustre.

Each separate reel has a so-called *conductor*, by which, incessantly moving to and fro, the threads, in strings three or four inches wide, are conveyed to the reel. This causes that, in more than a hundred revolutions, the thread gains time to dry off perfectly before another one covers it. Those strings should not weigh more than three or four ounces, to promote their drying. Before they are taken off from the reel, the silk must be cleaned of those sticking out or broken. The reel is for this purpose first loosened and afterward tightened again. A few hours later the silk can be removed.

The person that turns the reel has to pay close attention to any motion made or sign given to her by the one spinning. A contrivance, by means of which this latter one may either stop at pleasure or start the reel from its position by a pressure of the foot simply, is very advisable. A closer description of the whole machinery would not be necessary here.

An establishment especially employed for reeling purposes in every silk-worm-breeding district would do a great deal of good to the community, as in it the girls might be instructed in their work by competent persons, and the small breeders might find the necessary help not to waste or lose a part of their product. In Italy there are many such, that also buy from the farmers their cocoons at the regular market price, and work them up on their own account.

The Floret (coarse) Silk, and how it is made.

For this are generally used, 1. Those cocoons that are bitten through. 2. The waste silk when the original thread is hunted for. 3. The web surrounding the cocoon. 4. The thin skins surrounding the nymphs and remaining after the unwinding.

The manufacturing, and its converting into money, claims particular attention, but is not profitable to a single breeder. The following is the manner used in its making: 1. The cocoons of the first description are soaked in warm water for a few days, then washed out in river water, dried, and rubbed between the fingers, drawn out, and spun on the ordinary reel. 2. The other waste silk lots are dried over a coal fire until they become nearly brown, then beaten with a wooden stick and torn open by means of a dull knife. In order to moisten them again, they are then taken into a cellar for a couple of hours, besmeared with oil or lard, and carded like wool. The extracting of the silk from the cards is done with wetted fingers, twisting from right to left.

It is a remarkable phenomenon that this floret silk, placed upon a suffering part of the human body, is an efficient remedy against rheumatism and gout.

The Magnaries.

The name *Magnary*, derived from "*magna*," signifying "*silk-worm*" in the vernacular of the Provençales, is given to an establishment in which the breeding of the silk-worms is carried on on a large scale.

The house is generally formed by a *suterain* and one story, and may be constructed from light materials, as the breeding only takes place in the summer months.

In the *souterain* are frequently kept the reeling machines (*filanda*), besides the ovens and rooms. It is also used for stripping the leaves of the twigs for the food of the worms, and drying them in rainy weather. In the upper story we find the caterpillar-room, with its scaffolds and stages. The ceiling has several openings, through which the impure air can be let out by means of a ventilator.

The greatest possible care is taken in these establishments in regard to cleanliness, light, and warmth—the three main requisites for the welfare of the worms.

Since the manner of warming a house by means of hot air has been known, it has also been deemed advisable to introduce it into these establishments. The heated air escapes from the stoves, and is conducted by pipes to the breeding-rooms. Those pipes have round holes five or six inches distant to allow the air to stream forth.

APPENDIX H.

THE MANUFACTURE OF POTATO-STARCH AND GRAPE-SUGAR.

EXTRACTED FROM THE WORK OF DR. P. W. PHILIPPI.

APPENDIX II.

P. W. PHILIPPI ON POTATO-STARCH AND GRAPE-SUGAR.

Manufacture of Potato-starch.

THE manufacture of potato-starch is so simple, and so many directions have been given for it, that it will be unnecessary to enter upon the matter fully. Only in regard to the wash or cleaning apparatus for the potato-mash I wish to engage the attention.

The plain wash cylinders are in every respect excellent. They are almost entirely constructed of wood and metallic wire net. The cylinder consists of three separate pieces: the axle-tree, with an arm made of wood, and the two halves of the cylinder form, which are each separately covered on the inside with the required number of metallic gauze. The cylinder is divided in 12 parts, each division $4\frac{1}{2}$ inches apart, consisting of wire gauze fastened to fine wooden hoops in the cylinder. The axle rests upon a wooden frame in such a manner as to allow the potato-mash which enters at one end to come out washed at the other. Under this cylinder, resting on the same frame, is a box with tolerably high sides, not to allow any of the washed substance to scatter. This box has a fall of five inches. The rotation of the cylinder is from 12 to 16 times per minute. The water which is required to wash the potato-mash is brought into a pipe lying horizontally and above this cylinder. The under side of the pipe is sieve-like, to allow the water free egress and fall upon the turning cylinder.

This process may be repeated, and for that purpose a second cylinder may be placed under the first, in such a manner as to receive the washed substance without any farther labor or direction. It will be advantageous to have the wire gauze of the second cylinder more fine than that of the first. Number 11 and 15 may be used.

Manufacture of Grape-sugar.

1. *The transformation of Starch-flour to Grape-sugar by Acid.* —The first object is to procure the starch as clean as possible. Should this be bought for this purpose, it is advisable to try the following experiment: Take one pound of it, and dry it from four to six hours upon clean paper at a heat of 80° R. After this process it must be weighed, and the difference will show the quantity of water contained in the starch; or, take a few ounces of starch in a small glass retort; add some diluted sulphuric acid, and boil this from four to six hours. The sediment which re-

mains after this process is the impurities, which will serve to form an estimate of the goodness of the starch-flour.

Steam is used to boil the sugar; and to complete the fabrication of from 1000 to 1500 pounds of sugar, it will require an engine of four atmospheres proof. The vessel in which the starch is boiled may be of good oak staves, 1½ inches thick, or of pine staves, lined on the inside with lead. For the fabrication of 1500 pounds of grape-sugar daily, the size of this vessel may be: the height, four feet nine inches; upper width, four feet three; and the diameter of the bottom, the same. The steam-pipe enters the bottom of this vat, and is coiled there in a few turns. The upper side of the coil is supplied with many small holes for the escape of steam; the end of the pipe is closed.

The starch destined for grape-sugar is mixed with water to a thickness of molasses, in a vat used for the purpose. At the same time, 18 gallons of water are poured into the boiler. For every 1000 pounds of starch-flour, 24 pounds of English vitriol are added.

The steam is let on, and when boiling, portions of thinned starch, consisting of two gallons, are added slowly. Care must be taken that this fluid does not cease boiling, and also that the addition of the starch is done very regularly, to prevent it from forming paste; and also the fluid must not boil too much, for otherwise it may run over. During the boiling of the substance, it may be often skimmed.

Starch-flour boiled with vitriol will first form *dextrine*, and afterward *grape-sugar*. The complete transformation into sugar will require about ten hours.

2. *Neutralization of the Acid and Clarifying of the Sugar.*—For the neutralization of the acid will be taken carboniferous limestone, in form of ground limestone. One third of the substance required will be put in the neutralization vat; at the same time, put into the vat 24 pounds of ground bone-black. Now the sugar solution may run slowly into this vat, and be kept well stirred, to help the generation of carbonic acid and the forming of gypsum. If the lime is exhausted, more must be added, until the last of the sugar is drawn off. To know when the process is finished, the following experiment may be tried: After the solution has been stirred a quarter of an hour, take out a small portion and filter it. Take strips of blue litmus paper, and moisten them with the filtered fluid. If the paper, after being completely dry, turns reddish, then the acid is not fully absorbed, and lime in smaller quantities may be added, until this process will show the litmus paper in its original blue color.

After the neutralization of acid, it is necessary to free the solution of sugar immediately from the gypsum, otherwise the sugar would become of a bitter taste, and its color would be dark.

3. *Filtration through Bone-black.*—For this work are required a good press and a wooden frame containing about ten small linen

filters; then a wooden filter, of cylindrical form, which is lined on the inside with copper sheets, or a copper filter. This filter has two copper bottoms, of which one is sieve-like, and fastened to the sides. When this filter is used, a moistened cotton cloth must be spread on the bottom; after which, a layer of bone-black, about ten inches high, is brought on the same; it is then carefully moistened with pure water, and stamped gently. In this manner it will be continued with the bone-black until three fourths of the filter is filled. The false bottom is placed firmly on this filling, and covered with a cotton cloth moistened.

The neutral solution of sugar is brought in the linen filter first, from which the results will be put in the last-mentioned. The sediment remaining in the linen filters may be taken out, mixed with a little water, and then put under the press. The cake remaining in the press (gypsum and bone-black) will make an excellent manure. The solution of sugar received from this filter has lost the improper ingredients contained in it, as gypsum, etc., and is ready for steaming.

4. *The first boiling of the Sugar.*—The apparatus for this purpose vary as much in construction as in efficiency. So much is certain, that for this work it is not necessary to use a vacuum apparatus.

5. *Second Filtration through Bone-black.*—This sirup will require some pressure to pass through the filter, and apparatus for this purpose has been devised. The work of Dr. Philippi contains drawings of the apparatus used in this manufacture, which, however, we do not think it necessary to reproduce.

6. *The last Steaming, and the concentration of the Grape-sugar.*—For this purpose a rotary apparatus is preferable. When the sirup is concentrated to a consistence of 42° B., it is drawn off into a cooling-vat, and well stirred for half an hour. The forms to receive the sugar now must be invariably of wood, and must be moistened with cold water before the sugar is put into them. When the sugar has sufficiently hardened not to receive impressions from the pressure of a finger, it may be loosened in the forms. It is now brought into a room heated from 16° to 18° R., and kept to dry from 5 to 10 hours, after which the sugar will be ready for market. The analysis of Professor Dr. Fresenius, in Wiesbaden, showed it to consist of

Dry sugar	87.47
Water	12.28
Gypsum	0.25

The analysis proved farther that the grape-sugar was of an excellent light color, and of sweet, pure taste. Dissolved in water, it formed a very clear and pale sirup, and was free from dextrine, copper, or other metals.

Recovery of Bone-black.

For this purpose an old pipe may be taken, in which a false bottom, with many small holes, might be placed, from 4 to 6 inches above the original bottom. The bone-black is filled in this pipe upon the false bottom, and the steam is let on in the vacant space between the two bottoms. The bone-black is boiled some time, by which it will be sweetened. After this process the steam is shut off. For 100 pounds of bone-black will 2 pounds of calcinated potash be dissolved in water; with this solution the same then merely covered, and boiled by steam for 12 hours. The water is drawn off, which will be of dark yellow color. Pure water is poured on now to cover the bone-black a foot, and then brought to boil, after which the water is drawn off again. Again it is filled up with pure water to cover it by a foot; muriatic acid is added until litmus paper is colored light red from this water. In this state it must remain a few hours, when the fluid is drawn off and fresh water added until the water has no salty taste and blue litmus paper is not discolored, after which the bone-black is immediately ready for use.

All the waste which has accumulated during the steaming of the sugar, and the water with which the apparatus had been cleaned, might be saved, fermented, and distilled. The alcohol gained from such refuse is almost free of fusel oil, and of an excellent taste and flavor.

NOTE.—The reader must understand, however, that sugar made from potatoes is of no use for eating or cooking purposes, but is only used for aiding and ameliorating wines. As the potato-sugar is similar to the grape-sugar, it is by the Germans and French called grape-sugar.—A. H.

APPENDIX I.

BEET-SUGAR.

EXTRACTED FROM THE WORK OF K. J. EBERT.

APPENDIX I.

K. J. EBERT ON BEET-SUGAR.

The Beet and its Culture.—Estimating the Saccharine Matter.—Manufacture of Beet-sugar.—Cleaning the Beets.—Extracting the Juice.—Pressing.—Maceration.—Boiling.—Preservation of the Juice.—Defecation of the Juice.—The Concentration, Filtration, and Preparation of the "Spodium."—Evaporating Apparatus.—The First Evaporation.—The First Filtration.—The Second Evaporation.—Second Filtration.—Animal Coal.—Boiling in.—Crystallization.—Operations of the Filling-room.

THE BEET AND ITS CULTURE.

Of all the manifold varieties of the "*Beta ciela*," L., none has been more extensively used on the Continent of Europe for the purpose of supplying the yearly-increasing consumption of sugar than the White Silesian Sugar-beet—*Beta alba.*

Like the rest of the family, and even more than they, this species requires, above all, a soil that is composed of a sandy loam or a marl; the lighter it is, the better, in general, adapted for its cultivation. Wet or swampy and moory land ought by all means to be avoided. A good loosening of the ground by means of deep plowing will insure the prospect of a good crop, as the root thereby gets a chance to send its main shaft straight down, without branching off too much. As to manuring the field (if this be necessary), great care ought to be taken not to introduce too many saline parts (as these will only act detrimentally) into the soil by the wrong kind of manure chosen. That of animals, in general, should not be used; broken or pulverized oil-cake and bones will, however, produce good results.

In regard to the size of the beets, this has, in so far, an influence upon the quantity of the saccharine matter, that the larger they are the more water and other substances they will hold, and the less sugar. Those up to 1 and $1\frac{1}{2}$ pounds' weight, generally, are found to be the richest in sugar. It is mainly developed during the period of its actual growing until the beet has obtained its perfection and stalks are forming.

In answer to the question "how they shall be kept after being dug up from the ground," let it suffice to say that the more carefully they are shut out from the injurious influences of the sunshine, heat, and air, the better they will keep. To cover them up about three feet high with ashes will be found highly useful, as this will protect them also against the moisture.

In judging and examining a beet, it must show a small head, and be of a long and well-shaped form. It must not be grown

high out above the ground; and the less its root branches out into small ones the better. Corresponding to the firm meat and close texture of the fibres must be its thin and white skin. It must break off short and snapping; must have a sweet and pleasant taste, but by no means a salt or harsh one.

Of the density of its juice we can only ascertain by the application of certain instruments, the best of which are "Balling's Saccharimeter" and the "Aræometer," of both of which we shall speak hereafter. A very simple way to determine, as nearly as possible, the quantity of pure crystallizable sugar matter in the beet is given by Mr. Pelouze as follows: "The beet is cut into thin slices, and the sugar extracted therefrom by means of alcohol. Suppose 100 or 1000 of such slices taken, then the weight of the sugar secreting on the evaporation of the alcohol, expressed in grains and divided by 10, will give the number of per cents."

Dr. L. Gall, an eminent chemist in Trèves, proposes to ascertain the loss in weight which a liquid of sugar mixed with yeast suffers by fermentation. This loss corresponds to the quantity of carbonic acid formed, because this latter escapes. It will consequently be only necessary to weigh the liquid *before* and *after* the fermentation.

MANUFACTURE OF BEET-SUGAR.

The sugar-beet is composed of 81 per cent. of *water*, 11 per cent. of *sugar matter*, 4 per cent. of *fibrous matter*, and 4 per cent. of various other substances. By the subsequent process of fabrication, these 11 per cent. of sugar substance will, however, average not more than about 7 per cent. of *raw sugar*, and again of these only 5 per cent. of *crystallizable* and 2 per cent. of *sirup* or not crystallizable sugar; or, expressed in another form, 100 pounds of beets will result in 7 pounds of raw sugar.

The manufacturing process requires a number of operations, of which some are merely mechanical, others of a chemical nature. The first comprise the *cleaning* of the beets, the *extraction* of the juice, etc; the latter, the *clarifying* of the juice, its *concentration* and *filtration*, the *boiling* and *crystallization*, and the *refining* of the sugar.

Cleaning of the Beets.

The reason of this operation is too obvious to need explanation. It is conducted in a wooden trough or box, especially made for this purpose, with holes in the bottom to let the dirt flow off. This must be carefully attended to, the water repeatedly renewed, and with hands and hard brooms the soil adhering to the beets removed. After this, the hard top crust or the head of the beets must be cut off by a knife, also the remaining injured parts looked after, and the superfluous roots trimmed off, and small stones taken out that may stick in the skin or meat of the beet, in order that they may not injure the pressing machine.

Extracting the Juice.

This is done either by *pressing* or *maceration.* The former process is based upon the principle that the fibrous cells of the beets must be torn in order to let the sugar-matter contained by them escape. It is done by putting the beets, either singly or in small quantities, into a box in which works a cylinder of wood, upon which a number of teeth, made of sheet-iron or steel, are fixed in such a manner that at each motion or turn of the cylinder they press the beets rolling on to them through a feeding-hole against another row of steel or wooden teeth fixed at a certain distance above them, and in this manner lacerate the fibres. This mass falls into another box placed beneath, through the open bottom of it, and is thence transferred to the press itself. Of these there are several in use. The best, however, seems to be the *hydraulic* press.

Before this takes place the mass is put upon the so-called "press-cloth," or into "press-bags." The former are made of hemp, or cotton, or wool, the latter being the best; but they must not be washed in warm water when being cleaned, as then they would be apt to get filthy. When spread on such, it is rolled over with a wooden mangle and taken to the press, where it comes under the piston in layers one upon the other as high as convenient. Great care must be taken not only in putting the mass on the cloth in a solid cake form, but also in placing the various layers themselves so in the press that all parts of them are equally brought under the powerful action of the machine. After all the "cakes" have given up their fluid, they are taken out and others put in; in the mean time, the cloths of the former pressing are thoroughly cleaned.

The "maceration" process differs materially from the first; and its principal points are the following:

The cut and lacerated beets are put into an apparatus where hot water is poured over them, which removes the sugar from the juice-cells, or absorbs it. If the sugar contained in this liquid should not prove concentrated enough, when a reasonable time for extraction has been allowed, it must be refilled upon the next batch, and so on.

Besides these foregoing we have still the method of extracting the sugar matter by the application of *rollers*, *atmospheric pressure*, and *boiling* of the beets. The main features of this last process are the following: To boil the washed and peeled beets in a copper kettle, adding about ten per cent. of their weight of water, and then to press the juice out of this mass in bags, which, refiltered through a linen cloth into the newly-cleaned kettle, may be directly caused to evaporate to the crystallizing point. In this way, says the inventor, the entire liquid (by mixing with the concentrated juice while it is yet hot about $1\frac{1}{2}$ per cent. of its weight of powdered crystal sugar) changes, in a warm place, into a granu-

lous mass, which it only needs to fill into bags and press it out, in order to obtain, in from 14 to 30 days, the entire sugar that had been contained in the beets.

Preserving the Juice.

As the good result of the entire process depends on two main points—*cleanliness* in all the appertaining actions and instruments, and *expedition* in disposing of the juice to the boiling kettle, it becomes evident that the greatest possible care must be taken in regard to them. Referring to the latter, it will frequently be found inconvenient or impossible to attend to it as quickly as desired. In this case, the juice, when running out from under the press, which appears first of a clear white color, is conducted to the receiving-tub; it will, however, be found to have changed into *red;* and if left much longer in contact with the air, into *brown* or even *black*—a sure sign that the sugar matter gets rapidly decomposed. This is caused by the combination of the oxygen of the air with the albuminous matters in the beets, producing acids and forming slime, by which the aptitude of the sugar to crystallize is destroyed, and finally itself entirely dissolved. Various methods have been recommended and tried to avoid this evil; none, however, with perfectly satisfactory success. The best of them might be to add to the raw juice about two per cent. of the weight of the beets of acid sulphurous lime.

As to the first point, "*cleanliness*," we may add that immediately after one pressing process is finished and another one begins, all the implements in the room, without exception—even the floor and walls—must be carefully cleaned off, and the refuse and offal removed. The wooden instruments have to be washed, first with warm and afterward with cold water, and all wood parts of the room sprinkled over with lime-water. The bags and cloths must be exchanged for fresh ones.

The Defecation of the Juice.

This causes the removing of all substances from the juice which, being contained in the beets, would in any way act injuriously to the sugar by decomposing it, or hindering its perfect crystallization. It is, however, not a mere mechanical operation, but one that has to be executed by chemical application.

The most efficient agent for this purpose we have in lime; and the apparatus necessary for the defecation is called "the defecation kettle." It is generally made of iron or copper, at its lower end of half round, and thence upward of more cylindrical form. The bottom is a double one. In filling this a space of six or seven inches must be left empty to prevent the running over of the liquid.

The principal points of this process are,

During the Heating.—To close, after the kettle has been rapidly

filled, the air-valve, and to open both the steam-valves on it to let the steam enter the hollow bottom space. The time when the lime is to be added depends much on the quality of the beets; a thermometer must be at hand, however, and it might be well to appoint it at 60° to 65° R., that is, when the temperature of the boiling fluid has attained to that degree.

During the adding of Lime.—When this is done the steam-valves must be closed, and the necessary quantity of the lime dissolved in water quickly added, stirring it well into the fluid. After this the steam-valve is only partially, but the air-valve fully opened, and the foam now forming on the surface of the juice pushed back to observe the action of the fluid. Soon the albuminous flakes will begin to rise; the limy foam begins to burst and give way before the green scum. More and more this will concentrate, look dry, fleecy, and light. Finally, some parts of it will expand themselves considerably, and juice-fountains burst through them. Then the boiling liquid is defecated.

In regard to the quantity of lime to be taken, $\frac{3}{4}$ to $1\frac{1}{2}$ pounds of it would be quite sufficient for 100 pounds of beets.

The sediments in the kettle and the foam remaining can be put into bags and pressed out again, as they may contain sugar matter and sufficient juice to pay for the trouble.

Treatment of the defecated Juice.

Clear and transparent, this must be directly taken to the "evaporating pan," or, which is better, conducted to it by means of a pipe. Before it enters, it answers well to let it pass through a filter, in order to free it of its lime parts. These filters may be constructed from a tin or copper vessel, whose perforated bottom is covered with woolen or linen cloth, and a thin layer of bone-black. Some also neutralize the lime by the application of carbonic acid.

The Concentration, Filtration, and the preparation of the "Spodium."

The object of these actions is to remove the superfluous water mixed with the sugar of the juice, effected by a continued evaporating process and a filtering over animal coal. The first reduces the quantity of the juice to one ninth of its original volume; and as this can not be done by *one*, it must be so by a *second* repeated evaporation, and the latter takes place *after each* of these.

The evaporating apparatus consists mainly of a copper vessel resting upon a wooden stand, of a depth equal to about the fourth part of its diameter, closed by a wooden lid, leaving only a semicircular opening that also can be closed by a hinge cover, and of a conduit, through which the steam formed by the boiling may escape. Close by this there is a pipe, extending through the lid, with a faucet to let the defecated juice pass into, and another one at the opposite side of the bottom to let the evaporated off. One of the most important inventions of late years for the purpose of

the concentration of the beet-juice is the method of effecting the evaporation by means of the *vacuum.* Besides these there are several other constructions of pans; for instance, the one invented by Howard, another by Tischbein, and Daneck's apparatus.

The first evaporation is usually continued until the juice gets concentrated to about 10° or 12° of Beaume's scale. The vapors arising during it will, by their ammoniacal smell, indicate the presence of many azotic parts. The juice is then drawn off by means of a siphon, and conducted to the filtering apparatus.

The first Filtration.—For this purpose bone or animal coal is preferred. These, being filled into the apparatus, need a first cleaning of adhering dirty parts by cold water; after this, a second washing by warm water. Now the juice is poured upon them and left for about half an hour in connection with them. When it has passed through this operation, the juice is now subjected to

The second Evaporation.—It will here be treated in the same manner as at the first, and be found much purer and freer of lime parts than before. It must be concentrated up to 20° or 22° B., and is then allowed the

Second Filtration in the same apparatus, and a like manipulation as before. As a matter of course, the juice, now being concentrated into a thick fluid, penetrates the coals very slowly, and must be allowed ample time.

The Animal Coal, or "Spodium."—We need say nothing here about the manner of making this, as it is a very simple and generally-known one. Well-charred coals weigh 40 to 42 pounds per cubic foot. The net produce of the bones amounts to about 40 per cent. of their weight when fresh. The coal must have a deep black color, a firm texture, and, touched by the lips, stick to them; if so, it may be considered good. Pulverizing it is not advisable.

Boiling in of the refined Juice.

This is generally effected in two different ways; the one to be called the boiling in to the *string* or *clear* proof, and the other boiling in to the *grain* proof, and the boiling in of the sirup.

In adopting the first, the juice is only concentrated to the crystallizing point by applying a quick heat and a very careful manipulation. This tends only to a slow and regular formation of crystals, and to the producing of *raw sugar* in large crystals, that still needs refining before it can be brought out for sale. Before the mass gets too much concentrated, the kettle must be filled up again with fresh juice, and this repeated.

In the second case, which will produce *grain sugar* (melis) merely, a firm and dense texture and small crystals are intended in the sugar. The boiling must be continued until this proof is attained. It generally turns out a very difficult affair, and must be aided by an addition of already-made crystal sugar at the approaching of the crystallizing point of the boiling juice.

The boiling in of the sirup can only be directed to the producing of *raw*, but not of grain sugar. As the sirup boils very slowly, an addition of water will be found advantageous.

The various methods of proving the sugar, when it has attained the desired or necessary consistency, either by the finger or water, or the drawing out threads, the perling of the mass, etc., must rather be learned by practice, as this alone will show the proper moment. There are, indeed, several instruments to determine it, but too complicated to be of general use; as, for instance, the "Manometer," invented by L. Walkhoff, or the "Vacuum-Areometer" by Kwiech.

The Crystallization of the Sugar.

After the foregoing actions are gone through with, the mass has to be immediately taken to the "crystallization forms." The temperature of the filling-room must also now be increased to from 24° to 30° R., and kept at it.

The filling of the Forms in order to get raw Sugar in large Crystals.—This requires no other manipulation except to put the mass into the forms, in which it is left until the drawing-off process begins. The quicker it cools off the *smaller* will the crystals get; the slower, the *larger*. The shape of the former differs according to the wants. The one most in use for raw sugar is that of a box, square or round, toward the bottom somewhat narrower, with a wire sieve inside, beneath which the separated sirup flows off by an especial pipe or tube. It is called "Schützenbach's Box."

The filling the Forms to get Grain Sugar.—In this case the mass is put into forms of a particular shape. Formerly they used to be made of baked clay, of a conical shape, and placed upon pots (of urn shape, with an opening corresponding to the point of the former), in order to receive the sirup dropping out. They are now, however, preferred of sheet-iron, coated inside and outside with varnish, holding 32 pounds of the filling mass. These have also an opening at the point of their inverted cone to let the sirup off, which, before the filling commences, must be closed by a linen cloth fastened into it by means of a nail. The forms are then placed upon lath scaffolds, perpendicular upon their centre of the point, in parallel rows, and now the filling-in begins. They are left in their places until the next day, and then put upon the floor of the room.

The Filling-in of the boiled Sirup to get the After-product.—This, being regularly warmed up, is put into other iron boxes, and left quietly to crystallize, which will take considerably more time than the former methods.

Drawing the Sirup off from the Forms.—The time during which the whole crystallizing process finishes is of various duration. In the Schützenbach boxes it will generally be fouud after 18 hours; in the conical forms somewhat sooner. When the sugar has been

separated from the sirup in firm crystal bodies and cooled off (in which state it must fill the whole form out), the openings must be cleared by drawing the cloth pieces out, and a pointed iron rod introduced through them, penetrating several inches deep into the sugar mass. This opens the way for the sirup bound up between the crystals, and allows it to flow off. The Schützenbach boxes are, for this purpose, put a little upon their sides or edges. After from 36 to 48 hours, the sirup of well-boiled sugar will generally be all run out, and now follows

The taking out from the Forms.—With the sugar of the first-mentioned quality this is simply done by turning the boxes over on a table of stout boards, with borders, so that the sugar may fall out. The dirty upper parts of it are then taken off, and the pure remaining mass broken up by wooden pestles, to make it dry quicker and obtain a clearer color. With the sugar of the second-mentioned quality (*melis*), after the forms have likewise been opened to free them of the sirup, which will run out within six or eight days, a different manipulation takes place. Being taken off from their beds (small boards with round holes in them to hold the points of them), the uppermost (broad) layer of the sugar must be broken up by a small hand-mattock, and the new surface well leveled again by a scraper, so as to leave only a small cavity in the very centre of it. After this operation, the forms with the sugar yet in them are replaced in their beds. The produce of the entire mass of boiled sugar will generally result in 60 per cent. after the drawing off of the sirup, or five eighths of its weight of crystallized sugar and three eighths as sirup.

Covering the Sugar with Water.—The refuse of the sugar gained in the prescribed way must now be dissolved in pure water, and poured over the sugar in the forms. Penetrating this, it drives all the remaining sirup parts out, and takes up their places, thereby acting as a purifying agent. If the first infusion should not suffice, it may be repeated after 24 hours or 36. Frequently a third time will be found necessary to make the sugar white and nice-looking. Before this is added the surface has to be loosened again, to give it a better chance to enter. After this, when the last sirup coming out of the opening appears perfectly clear and colorless, the sugar can be taken out of the forms. If good, it must show a uniform whiteness, no yellow spots or stripes, and an equal grain throughout. The raw sugar, as first product, receives a similar covering with water, if found necessary, in the Schützenbach boxes, placed for the purpose upon stools. The after-products from sirup may be covered, according to option, either with water or sirup.

Refining the Sugar.—Those kinds of sugar that are destined to go through the process of being refined are broken into pieces, and dissolved in water to about 30° concentration. This solution, after being warmed up to 50° or 55°, receives an addition of 1 or

2 pounds of animal blood to each 100 pounds of it, must then be increased in its temperature to 60° or 65° R., and have another addition of 4 to 6 per cent. of finely-powdered bone coal, and the entire mass be brought slowly to boiling. Soon the signs of the intended refining will show themselves, and be entirely finished when the solution appears transparent, clear, and a white foam, with transparent bubbles, rises up from out of the surface of the boiling substance. This must now be drawn off, and conducted over coal filters before it can be farther boiled. In order to remove the coal remnants and other impurities, *albumen* (white of eggs), stirred in water, may be mixed to it while boiling. As to the rest, it is subjected to the same manipulations as before spoken of.

APPENDIX K.

THE SORGHO AND IMPHEE.

EXTRACTED FROM THE WORK OF HENRY S. OLCOTT.

NEW YORK (*Sixth Edition*), 1858.

APPENDIX K.

H. S. OLCOTT ON THE SORGHO AND IMPHEE.

Introductory Note.—First appearance of the Sorgho and Imphee in Europe.—Various Experiments.—Mr. Leonard Wray.—Introduction of the Sorgho into America.—History of Sorgho in the Southern States.—Soils required.—Yield of Seed and Fodder.—Making Sugar or Sirup on a small Scale.—Boiling and Clarifying.—Reducing to Sugar.—Mr. Wray's Patent.

Introductory Note.

[We have reflected much, and from time to time urged, either through the public press or in speeches at agricultural fairs before farmers, the necessity of raising such articles as less favored countries can not produce. It must be apparent to every person that with our high labor we are not able to compete with our countrymen on the other side of the Rocky Mountains in raising wheat, barley, and oats. Labor for some time to come must be high; in fact, as long as the gold grounds will furnish hope to a man of getting rich, he will go there as soon as he has earned enough on a farm to keep him a few months prospecting.

With this circumstance before us, we naturally inquire, What can we plant to make a sure living, employ the least part of our land and working stock, implements, etc.? It is positively certain that raising grain will not only pay us nothing, but will make us bankrupt.

To be able to recommend some produce which would pay better than small grain, we have made a European tour and diligent searches for a profitable produce. We started out from home determined to examine the sugar-beet, fields, factories, etc., to ascertain the yields per acre, profits, and manufacturing, etc., and the results of our inquiries have been given in the preceding pages. It was well known that the sugar-beet has been cultivated in France and Germany, and that sugar has been manufactured from the same for many years; that it must have been a paying business there is proved by the increase of the sugar made from the beet.

We reasoned thus: If raising the sugar-beet where land is fifty or even a hundred times as high as in California; where the land must be manured at a cost of from fifteen to twenty dollars per acre; where all taxes are high; and, above all, where sugar-beets do not grow so well as in California, why, then, should it not pay here, and pay well? Therefore we made diligent inquiries while there, and found that the culture of beets pays from fifty to a hundred dollars per acre; the fact that this branch of agriculture spread with rapid strides is sufficient proof of its excellency. In all the European domains, France, Germany, England, Hungary, Sweden, and even into Russia it has extended; and, with all its increase, the demand for sugar is greater and greater every year, and the price, instead of diminishing, increases.

However, finding that within the last three or four years the *Sorgho* and *Imphee* were introduced into France with great success, and in many places where the sugar-beet was planted the Sorgho and Imphee have been introduced instead, and the time is not far distant when this latter produce will put away the beet-root altogether, I became convinced that the Sorgho and Imphee are superior to the sugar-beet for the purpose of making sugar, or for fodder for cattle.

In order to furnish some idea of the value and importance of these plants to our agriculture, I give a few extracts from the valuable work of Mr. Henry S. Olcott, "Principal of the Westchester Farm School," Mount Vernon, near the city of New York, on "The Sorgho and Imphee." This work contains full information respecting these plants, the mode of culture, and the processes of making sugar, embodying the author's own experience and observation, and the results of the various experiments made in the various parts of America and Europe. It also contains illustra-

tions of the implements and apparatus necessary for the production of sugar upon a large or small scale. The work, being published in New York at a moderate price, is easily obtained in California, where I am happy to learn that a large number of copies have been sold. Every farmer who proposes to cultivate these plants will do well to provide himself with a copy of Olcott's work. The brief extracts which I have made are sufficient to show the importance of the subject to the agriculture of our State.—A. H.]

THE SORGHO.

First Appearance in Europe.

Its first appearance in Europe dates back no farther than the year 1851, at which time the Count de Montigny, consul of France at Shanghae, in China, sent to the Geographical Society of Paris a collection of plants and seeds which he found in China, and which he thought would succeed in his own country. Among these was the celebrated Chinese yam (*Dioscorea batatas*) and the *Holcus saccharatus*, under the name of "the sugar-cane of the north of China." Curiously enough, there was received in France at about the same time a quantity of seeds of a plant having apparently the same properties and almost the same appearance as the Sorgho, which had been discovered on the southeast coast of Africa, in the country of the Zulu Kaffirs, by Mr. Leonard Wray; and upon comparing the plants derived from these widely separate sources, the remarkable fact was made apparent, that in ability to yield crystallized sugar, to afford nourishment for stock, and in the requirements of cultivation and other peculiarities, they were almost identical.

Various Experimenters.

Experiments were likewise instituted by members of the Imperial Acclimation Society, but by none were they more zealously pursued, nor more successfully carried on, than by the Compte de David Beauregard. This gentleman was so confident of its value that he made strenuous efforts to increase his stock of seed, planted the greatest possible area of land with it, and succeeded so completely that it is from his third crop that has been derived the major portion of the immense amount that has been planted in the United States. In France we find it successively spreading in the provinces of La Drôme, Les Pyrénées Orientales, La Haute-Marne, La Gironde, Le Gers, etc., and every where exciting the greatest attention among the most distinguished agriculturists; and thence it quickly finds its way to Algeria.

Mr. Leonard Wray.

Mr. Wray is widely known to the sugar-planters of the world from his authorship of the "Sugar-Planters' Companion," published in Calcutta in 1843, and the "Practical Sugar-Planter," published in London in 1848, and republished in French, Spanish, Portuguese, and Dutch. In 1850 he left the East Indies for the Cape of Good Hope, whence he went to Kaffirland, and found the Zulu Kaffirs cultivating the Imphee around their huts, not for the purpose of manufacturing crystallized sugar or obtaining any other of its products with a commercial view, but merely for the purpose of chewing and sucking the stalks. He quickly saw of what value such plants were likely to become to Europe and America, and applied himself to their study, their culture, and manufacture

into sugar, etc. After having fully satisfied himself on these points, he returned to Europe, and planted patches in England, France, and Belgium; applied for patents in various countries; addressed the French government through Marshal Vaillant, Minister of War; exhibited specimens of sugar and the plants to Mr. Buchanan, then American minister at London; and subsequently established the culture of the Imphee in Turkey, Egypt, the West Indies, the Brazils, the Mauritius, Australia, and finally in this country. The gift that he thus made to our agriculture may be estimated when we reflect that we have almost every range of climate known in the world, from the torrid and fervent heats of the tropical zone to the most rigorous winters of the north; and, his plants requiring in some instances but ninety days to run through the whole course of vegetation and ripen their seeds, others of greater saccharine richness requiring a more lengthened season than is necessary for the ordinary sugar-cane, he has thus given to the farmers of every section of the country the opportunity to select from out his collection of varieties some one peculiarly adapted to the latitude in which he resides. In the year 1856, Mr. Wray obtained the large silver medal of the *Exposition Universelle* at Paris for his Imphee sugar, alcohol, seeds, and plants; and the French government, moreover, granted to him twenty-five hundred acres of land in Algeria, to encourage in that colony the establishment of this important cultivation.

Introduction of the Sorgho into America.

In the month of November, 1854, D. Jay Brown, Esq., of the United States Patent Office, returned to America from Europe, bringing with him a quantity of the seed of the Chinese sugar-cane. These seeds were distributed to various persons throughout this country; but the feeling of suspicion with which all new things are more or less viewed tended to confine this experiment of cultivation to a few of the more enterprising farmers, until the formal report, addressed by Gen. J. H. Hammond, late Governor of South Carolina, to the Secretary of the Beach Island, South Carolina, Farmers' Club, awakened general attention. Upon the publication of a circular, containing the experiments of Colonel Peters, and the notice of the sirup which was exhibited by him at the Fair of the United States Agricultural Society, the general excitement upon the subject was at once considerably augmented; and the subsequent appearance of the reports to the French Minister of War, the experience of American farmers in different parts of the country, the excellent pamphlets of Mr. J. F. C. Hyde, of Massachusetts, and Mr. Charles F. Stansbury, of Washington, all have united in lending this increase to the all prevalent interest.

History of the Sorgho in the Southern States.

Mr. D. Redmond, Associate Editor of the *Southern Cultivator*, gives the following account:

In the winter of 1854–5, I obtained per mail, through a seed-importing house in Boston, two ounces of what was then denominated "Chinese Sugar-cane, or Holcus saccharatus." I am not aware that any of this seed had been distributed from the Patent Office in this neighborhood up to that time, nor had I then any other evidence of its value than the newspaper advertisement which induced me to send for it. I have since learned, however, that the Patent Office distributed a small quantity of seed in the spring of 1854; and that, prior even to that time, the plant had been tested to a limited extent by a few gentlemen in the vicinity of New Orleans. Nothing satisfactory, however, was known of the plant here at that time; and wishing to have it thoroughly tested, I sent small samples, per letter, to various agricultural and horticultural friends in Georgia and the adjoining States, requesting them to communicate to me the result of their experiments with it. For myself, I merely planted seven or eight hills, in rather poor ground, in my garden, and watched its growth with considerable interest. At first I was disappointed, and quite ready to rank it among the many humbugs of the day, as it came up very weakly, like grass or Egyptian millet, and grew off quite slowly. In a few weeks, however, it began to shoot upward with great rapidity, and in less than three months attained the height of ten feet, with large and well-filled heads of seed. When these seeds were nearly ripe, I incidentally cut one of the stalks, peeled off the hard outer husk, and was quite surprised to find a solid pith or core, of about three fourths of an inch in diameter, crisp, brittle, and of an exceedingly sweet and pleasant flavor—entirely unlike any thing of the corn-stalk family that I had ever tasted. It was, in fact, *ready-made candy;* and as soon as the younger members of the family and the negroes "got the taste" of it, I was obliged to interdict its farther use, in order to save seed. When the latter were fully ripe, I cut off the heads and saved them carefully, noticing, with some surprise, that the leaves or blades of fodder were still as fresh, green, and succulent as ever. The stalks were then cut off near the ground, and fed, leaves and all, to my horses, mules, and milch-cows, all of which ate of it with the greatest apparent relish and avidity. Considering that crop disposed of for the season, I paid no more attention to the stubble or stumps until I happened to notice that, millet-like, they were shooting out anew, and pushing on for a second growth. This growth I watched with some interest until the first frosts checked it, at which time the stalks were six feet high, full of broad and juicy leaves, and with the second crop of seed just making its appearance above the "boot."

Convinced by this time that it was valuable at least for the production of soiling forage and dried fodder, I next turned my attention to its saccharine properties, and fortunately induced my friend, Dr. Robt. Battey, of Rome, Ga., who was at that time pursuing the study of experimental chemistry in the well-known laboratory of Prof. Rooth, of Philadelphia, to test it. As the result of his experiments, Dr. Battey sent me three small phials—one containing a fine sirup, one a sample of crude brown sugar, and the other a very good sample of crystallized sugar. This I believe to be the first crystallized sugar made in the United States from the juice of the Sorgho sucré; and as Dr. Battey's opinion of its value as a sugar plant fully agreed with the reports of the French *savans*, who had investigated its properties, and with my own convictions, I disseminated the seed more widely during the year 1856, and planted nearly two acres, for the purpose of raising the seed largely, and more fully testing the saccharine property and the ability of the plant to bear repeated cuttings, like the Egyptian and other varieties of millet. It was planted very late, on thin land, and received but imperfect culture, and yet I that year cut it *three times*, and saved a late crop of fodder from it in addition. The present year (1857) I have cut it *four times* up to the present date, August 26.

During the summer of 1856, particular attention was called to the sirup-making properties of this plant by the Report of Governor Hammond, of South Carolina, whose experiments had been most ably and carefully conducted.

This Report was read before the "Beach Island (S. C.) Farmers' Club," and was followed by that of Colonel Peters, of Atlanta, and others, all of which were published, and presented such satisfactory results that the agricultural community generally were aroused to the importance of the new "sugar-cane," and desirous of giving it a trial. The largest growers of the plant at this time (1856) were Absalom Jackson, Esq., of Montgomery, Ala.; Col. R. Peters, of Atlanta; Dr. Whitten, of Hancock Co.; Dr. Daniell, of Decatur, Ga., and the writer. The seed raised by these persons was, we believe, nearly all saved, and very widely disseminated over the Union, but principally through the Southern States, where, unquestionably, the plant attains its fullest and most perfect development. Twenty or thirty thousand packages of the seed alluded to were scattered over the country, and in the South alone probably thousands of acres are now growing. A large number of the growers are preparing to convert the juice of the Sorgho into sirup and sugar; and if an easy and economical process for crystallizing the latter can be employed, this plant will at once become one of our most important staple productions. I have, within the past two months, received letters from gentlemen in nearly every one of the Southern States, who were raising the cane from seed which I furnished, and the terms of praise and

even enthusiasm with which they dwell upon its good qualities are truly gratifying to me. Upon the whole, therefore, the Sorgho may be considered a decided success in the South, and the results obtained may be briefly summed up as follows:

1. An acre of the stalks, properly cultivated, on fair land, will yield from three hundred to six hundred gallons of excellent sirup, equal to the best New Orleans, and worth, at present prices, from forty-five to seventy cents per gallon.

2. If planted early, it will fully ripen *two crops* of seed and two crops of cane for crushing; as new shoots are invariably thrown out from the roots, and attain full development after the first cutting, which takes place about the 25th of July, in this latitude, in favorable seasons.

3. From 25 to 100 bushels of seed can be raised to the acre, which seed, for all feeding purposes, is at least as valuable as oats.

4. It bears repeated cutting when green, and is inferior to no other plant for "soiling."

5. The seed and fodder are fully equal in value to an ordinary corn-crop, thus leaving the canes and their juice a clear profit to the cultivator.

6. It withstands our long droughts much better than common corn, retaining its green color and succulence even after the seed matures.

The various economical uses to which the Sorgho may be applied are so fully adverted to in other portions of this work that it is unnecessary to enter farther into detail, and I will close by expressing the conviction that, wherever the climate is suitable to its proper development, this plant will fully realize all its most sanguine friends have ever claimed for it.

Soils Required.

[Mr. Olcott gives full directions for the mode of culture of the Sorgho, with notes of the experiments of various persons. We quote a few paragraphs.]

When we say that the Chinese sugar-cane can grow upon all soils on which a fair crop of Indian corn can be raised, we have almost covered the entire question, and given the desired information. The experiments which have been made upon it in Algeria, France, and this country, have proved the fact that the best results are obtained on loose, deep soils; but it has been demonstrated that the juices of plants grown upon soils largely composed of vegetable *detritus* is more abundant in fecula, and the sugar manifests a somewhat weaker propensity to crystallize than upon any others; but in such cases, as it contains a large quantity of fecula, it can be readily converted into alcohol. M. Paul Madinier says that for it are especially suitable light, sandy soils and calcareous soils, but particularly those formed from alluvial deposits. That in nearly every case, especially in Algeria and the southern part of France, very excellent results will be attained by

the employment of irrigation during the early stages of its growth, and when it is most rapidly developing itself; but that if employed at a later date, when it is approaching maturity, it proves deleterious, by impeding the elaboration of the saccharine principle, and rendering the canes too watery. M. Hardy, the intelligent director of the Government Nursery in Algeria, says that the Sorgho flourishes extremely well on soils containing carbonate of lime, and he advises frequent liming of such soils as are deficient in it. This recommendation finds its explanation in the astonishing success of the Sorgho on the chalky soils of Champagne, where otherwise they obtained very mediocre results; but, says M. Madinier, if calcareous applications seem desirable, it is by no means the same of such other saline manures as have been found by experience to be unfavorable for the sugar-cane and the sugar-beet. Lacoste urges upon his readers to avoid attempting the Sorgho culture on soils where the soluble inorganic matters are very abundant, because they would thus be exposed to the undesirable perplexity of producing juice in their plants of a saline character, and completely unsuitable to the extraction of sugar. Count Beauregard says that the Sorgho will flourish well on almost all soils if they be underdrained and irrigated; but his experience shows him what would be supposed by any sensible man, that the best results are obtained on soils of the best quality that are best cultivated.

Yield of Seed and Fodder.

In respect to the yield of seed per acre, the North, says M. d'Ivernois, can not hope to equal the South, where sixty bushels are produced. This result was obtained in the neighborhood of Hyéres. Colonel Peters, of Georgia, obtained twenty-five bushels per acre, of thirty-six pounds per bushel. Governor Hammond, of South Carolina, weighed a peck after three days' drying in the sun, and found the weight to be thirty-eight pounds per bushel. I have weighed several lots from Vilmorin, Andrieux, & Co., of Paris, and Count Beauregard, and found the weight to vary from forty to forty-eight pounds. Mr. Hyde says the yield is from twenty-five to fifty bushels to the acre. Thus we see that on partially exhausted wheat soils, or alluvial soils, both of which are specially adapted to the Sorgho, instead of a poor yield of wheat, we may plant the former, and, not taking any thing else into consideration, obtain a crop of from twenty-five to sixty bushels of seed. Mr. Brown said that nine tons of dry fodder had been cut in Kentucky last season: Hon. Marshall P. Wilder, president of the United States Agricultural Society, tells me that he knows one instance where 19.844 lbs. of fodder had been obtained, the weight taken after a three months' drying. The weight of the green stalks varies from seven to forty tons, according to circumstances. The director of the Government Nursery at Hamma,

Algiers, in his report to the Minister of War, says he got a result of 83,250 lbs. of green forage per acre. Our own Patent Office Report for 1855 says, "Aside from other economical uses, its value for feeding to animals alone, in every section of the Union where it will thrive, can not be surpassed by any other crop, as a greater amount of nutritious fodder can not be obtained so cheaply in a given space within so short a time; and without wishing to present the question in an extravagant light, it may be stated that this crop is susceptible of being cultivated within the territory of the United States to an extent equal to that of Indian corn, say 25,000,000 acres per annum; and estimating the average yield of dry or cured fodder to the acre at two tons, the yearly amount produced would be 50,000,000 tons, which, to keep within bounds, would be worth at least $500,000,000, besides the profits derived from the animals in milk, flesh, labor, and wool."

Making Sugar or Sirup on a small Scale.

[Mr. Olcott gives full instructions for the manufacture of sugar on a large and small scale. We quote only his directions for the latter.]

For the benefit of a large class whose facilities or inclinations have induced them only to plant a small patch of Chinese sugar-cane by way of experiment, yet who, nevertheless, are desirous of making a trial of sirup or sugar making on their own account, I subjoin the following description of a process by which, at a trifling expense, both sirup and sugar may be manufactured in a small way for family use by any farmer or householder who has but a few canes growing in his garden, and which may be applied to any operation on from five to twenty-five gallons of juice. Of course, the first thing is to permit the Sorgho to fully ripen, as in that condition it makes the best sirup, and will be free from the grassy flavor complained of in previous experiments. This is known by the seeds becoming black and hard. When fully ripe, then, with a corn-cutter, a large carving-knife, or, what is better, a small hatchet, cut the canes off close to the roots, strip off their leaves as far as the joints extend, and chop off the rest of the stalk, saving the seeds for future planting if the cane proves to be of good quality; if not, give them to the chickens.

The next thing is to extract the juice from the stalks or canes. This must be done by pressing them between rollers. If there is a cider-mill on the premises, it will be all-sufficient. Pass them through it just as you would crush apples, catching the juice in some clean vessel with as few chips or dirt in it as possible. Now build a fireplace with stones, or set up two forked poles, and put another across, on which sling your pot, which may be of sheet tin, but had better be of cast iron. Let it hold say ten gallons. Get a small tin skimmer at a tinsmith's shop, and you are prepared to commence boiling.

Boiling and Clarifying.

Every thing being ready, slack a teacupful of lime, mix it to the consistency of cream, and set it by for use. Light your fire, with charcoal if you have it, for it makes no smoke, but if you have none, use dry kindling-wood. If possible, so arrange your rude fireplace as to let the fire reach no more than halfway up the sides of the pot. Put five or six gallons of juice into the pot, set it on the fire, and, when it becomes milk-warm, add one large tablespoonful of the cream of lime, and mix it thoroughly through the juice. Now take the whites of two fresh eggs, beat them up with a teacupful of *the juice* from the pot, and when thoroughly mixed, pour back, and stir them well through the mass; bring it to the boil as soon as possible; *but, the moment you see the first signs of boiling, lift the pot off the fire*, set it on the ground, and let it remain quiet for fifteen or twenty minutes. You will have perceived that, after adding the cream of lime and eggs, as the simmering went on, a thick scum began to rise; this *you must not disturb*, but allow to gather on the top, till you take the pot from the fire as directed, and allow it to settle fifteen or twenty minutes. At the end of this time carefully remove the scum, and you will find, if you have carefully followed these directions, that the juice has become clear and bright, ready to boil down to the consistence you require, whether of sirup or sugar. Having removed the scum, empty the contents of your pot into some clean vessel, which have convenient. Fill up your pot again with the raw juice, and proceed as before. This is the process of clarifying or *defecating*, and is absolutely necessary, if you do not wish to have a dark, dirty sirup, tasting of cane-stalks, and almost unfit for use.

After clarifying and skimming the second potful as directed, set it back on the fire, and boil down as rapidly as possible. As the quantity reduces by boiling, keep adding fresh juice from the first clarification, so as not to let the sirup get too low in the pot, or it will get burned. If any scum rises, remove it with your skimmer; and by following these directions, you can not fail to make good sirup. The preceding remarks suppose that you have only *one pot* to operate with; but it is very much better to have two, as it will save twenty minutes' time, and fuel, with each kettle of sirup you make; because, as I have shown, you have to wait twenty minutes after taking the pot from the fire to allow the scum to rise and settle; so, if you have not another potful of fresh juice to put on, it is so much time and fire wasted. With two pots in use, you replace the first on the fire as soon as you take the other off, and proceed to boil down. Should you wish to make a very extra sirup for table use, get a flannel bag, of almost any shape, sufficient to hold two or three gallons, and filter the juice through it after you have skimmed it; then boil down as before.

It is a matter of importance with those who have never boiled sirup to know when the juice is boiled enough. There being nothing like experiments, I would advise such to procure a cupful of molasses, heat it, and, taking up a small quantity on a spoon, to watch how it runs down, and when the drops come, how they elongate and break in the middle, the upper half springing back with a jerk, and the lower forming a ball and falling into the cup again. Three cents in money, and the expenditure of five minutes' time in this way, will go farther in educating the eye to a good judgment than an elaborate series of directions. I will give one other method, however, of knowing when sirup is cooked enough. Dip your skimmer into the boiling liquid; take it out, and allow the sirup to run off it; a few drops will remain on the edge, falling at intervals. If these break with a long string between, which at the break jerks back into the dipper again, and which, when taken between the finger and thumb, feels *like molasses*, it is fair to suppose your sirup is sufficiently boiled, and you may take it from the fire.

Reducing to Sugar.

For making sugar, it will be necessary to boil this same sirup down till the steam escapes from it in little puffs, and when the skimmer is dipped into it, the falling drops break short and fall solid. These simple tests, and perhaps a few failures, will enable one to make good sugar. When enough has been boiled, pour it into a wooden box or tub to cool slowly, standing it in a warm place. Let the box be large enough to allow of the sugar standing only 1½ inches deep; boil another lot, and pour over the top of the first, and a third over the top of the second; mix them all together, and allow the contents to cool. If, by the next morning, there should be no signs of crystals, take a handful of raw sugar and stir it in; in all probability it will start crystallization; but if it should not do so immediately, do not despair, for it may stand for an entire fortnight, and then suddenly *strike* into sugar.

Mr. Wray's Patent.

Leonard Wray, of London, ***England.*** **Letters Patent, No. 17,713, Dated June 30, 1857. Patented in Belgium, June 20, 1854.**

To all whom it may concern:

Be it known unto all men, that I, Leonard Wray, of the City of London, in the United Kingdom of Great Britain and Ireland, have discovered a new process or method of making crystallized sugar, sirup, and molasses from all the African and Chinese varieties of the "*Imphee*" or "*Holcus saccharatus*" of Linnæus, often denominated "*Sugar millet*," "*Sorghum saccharatum*," "*Sorgho sucré*," etc.; which process is also applicable to the manufacture of the same products from the juice of the maize, broom-corn, the sugar-maple, etc.

The process constituting my said invention may briefly thus be stated: I take the stalks of the said plants, and obtain the juice contained in them by any ordinary and well-known method. This raw saccharine juice I then treat with lime, or cream of lime, until it has lost all trace of acidity, and even becomes sufficiently alkaline to affect, in a slight degree, turmeric paper, or other equally sensitive test paper, when I at once remove the said juice into a suitable filtering or other apparatus for separating the feculencies or coagulated matters from the juice, so as to obtain a clear bright liquor or juice, without having subjected it to any heat whatever. This clear bright juice or liquor I then put into a suitable vessel, and apply heat until the temperature rises from 120 to 180 degrees Fahrenheit, when I treat it with a dilute infusion of powdered nut-galls, or other substance containing tannin, neutralizing any excess of tannin that may have been accidentally given, or any acid which may have become liberated, by the addition of a little lime, cream of lime, or lime in any other suitable combination; I then urge the heat until the liquor has arrived at the boiling point, at which it should be kept for a few moments, when the heat is withdrawn, and the liquor is again filtered and rendered clear.

This clear defecated liquor is next evaporated, and, if in open pans, the scum is taken off as it rises, and the evaporation is continued, either in open pans or in any *low temperature* apparatus, until the liquor is sufficiently concentrated to permit of its granulation or crystallization taking effect in proper receptacles, into which it is placed for that purpose. If it should so happen that the said concentrated juice exhibits a disinclination to granulate or form crystals, then the addition of a few ounces of well-grained dry sugar may be had recourse to, which will immediately cause a granulation of the concentrated sirup. It must be well understood that I make use of *charcoal once*, *twice*, or *thrice*, in the filtration and decolorization of the juice and sirup; or, on the other hand, I do not use it at all, just as I may see fit and expedient. When the new sugar is properly granulated, its molasses is separated from it by the usual methods now employed.

It must be distinctly understood that the mere idea of cold filtration is not unknown, because numerous attempts have from time to time been made to filter the raw juice of the sugar-cane before applying heat thereto, and small quantities of lime have been put into the said raw juice before filtration, in order to prevent the acidification and fermentation of the juice during filtration, and before it could reach the *boilers* and be boiled; but my distinct and well-proved method is that of adding lime, or cream of lime, to the raw juice until it loses all traces of acidity, and it becomes sufficiently alkaline to affect slightly the color of turmeric paper, or other equally sensitive alkaline test paper. The chemical principle involved in this process I will now explain, so as to

demonstrate the very peculiar and distinctive character of my treatment, distinguishing it, therefore, from all other methods.

The juice, as it comes from the mill, I have always found to be palpably *acid;* the *first* effect of the lime, therefore, is to neutralize the juice; secondly, to regulate (by a farther addition of lime) as large a quantity of the feculencies as possible, by saturating the acids which hold them dissolved in the juice. When the lime has in this manner combined with the acids, and liberated the feculencies, whatever lime may be in excess tends to make the juice *alkaline*, which the turmeric paper immediately denotes, showing the necessity of *instant* filtration, which yields a beautiful clean, clear bright juice, *without* any *heat having been used*, leaving in the filtered juice, besides the sugar and water, only a little *dextrine*, caseine, and *saline* matter. By this simple process, a host of troublesome albuminous, glutinous, gummy, waxy, and mucilaginous matters, combined under the general head of *feculencies*, are got rid of entirely, before they can act injuriously upon the sugar contained in the juice, which they infallibly do the moment we apply *heat* to the undefecated mass. Having thus obtained this bright raw juice, I next treat it in the manner already specified, with heat, infusion of nut-galls (or other analogous substance containing tannin), and cream of lime, lime-water, or other suitable combination of lime, and then filter, so as to get rid of the *dextrine* and *caseine*, or as much of them as is possible, previous to subjecting the juice to continuous heat.

The mere idea of using an infusion of nut-galls or other tannin substances in sugar-making is not new, inasmuch as these substances have been recommended and even been tried by W. J. Evans, M.D., of London, in whose work, the "Sugar-Planter's Manual" (1847), it may be found at page 101; but it will be at once observed that the manner of employing it or them, as laid down therein by Doctor Evans, is ENTIRELY DIFFERENT from my own method; for he applies the infusion of nut-galls to the *raw green* juice in the clarifier, just as it comes from the mill, and *previous* to any other defecation having taken place; whereas I, on the contrary, first *defecate* the *cold raw green* juice by means of lime, cream of lime, or other suitable preparation of lime (as hereinbefore set forth), and then filter the juice so treated, thereby getting rid of the great mass of green feculent matter contained in it, and obtaining a clear, bright, and almost colorless juice or liquor, previous to applying any heat whatever, and previous to the venturing upon any application of the infusion of nut-galls or other tannic substances, thus forming a totally distinct method of using and applying the said tannic substances to the juice.

My process, therefore, consists, *first*, in the cold defecation of raw juice by means of lime, or other suitable combination of lime, immediately followed by filtration, as hereinbefore particularly de-

tailed; and, *secondly*, the treatment of the clear bright juice or liquor resulting from this cold defecation, with infusion of nut-galls or other suitable tannic substances, aided by heat in suitable vessels and subsequent filtration, as hereinbefore described; together making, as a whole, one plain consecutive process, which I have herein fully and faithfully explained and set forth, and which has never been suggested nor employed by any one else before.

These comprise the whole of my treatment; and I submit that they constitute an entirely distinct and new process, being one whereby excellent crystallized sugar has been, and can always be made from the plants I have before named. And I therefore claim the process as herein set forth, and desire to secure the same by Letters Patent.

THE END.

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